

DEVELOPMENT DIGEST

A quarterly journal of excerpts, summaries, and reprints
of current materials on economic and social development

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CONTENTS

Volume XII, Number 4

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LIMITS TO GROWTH?

- THE LIMITS TO GROWTH 3
MIT International Project Team
Dennis L. Meadows, Director
- REPORT ON THE LIMITS TO GROWTH 32
World Bank Task Force, Mahbubul Haq, Chairman
- ECOLOGISTS VERSUS ECONOMISTS 44
Hazel Henderson

AGRICULTURAL MARKETING

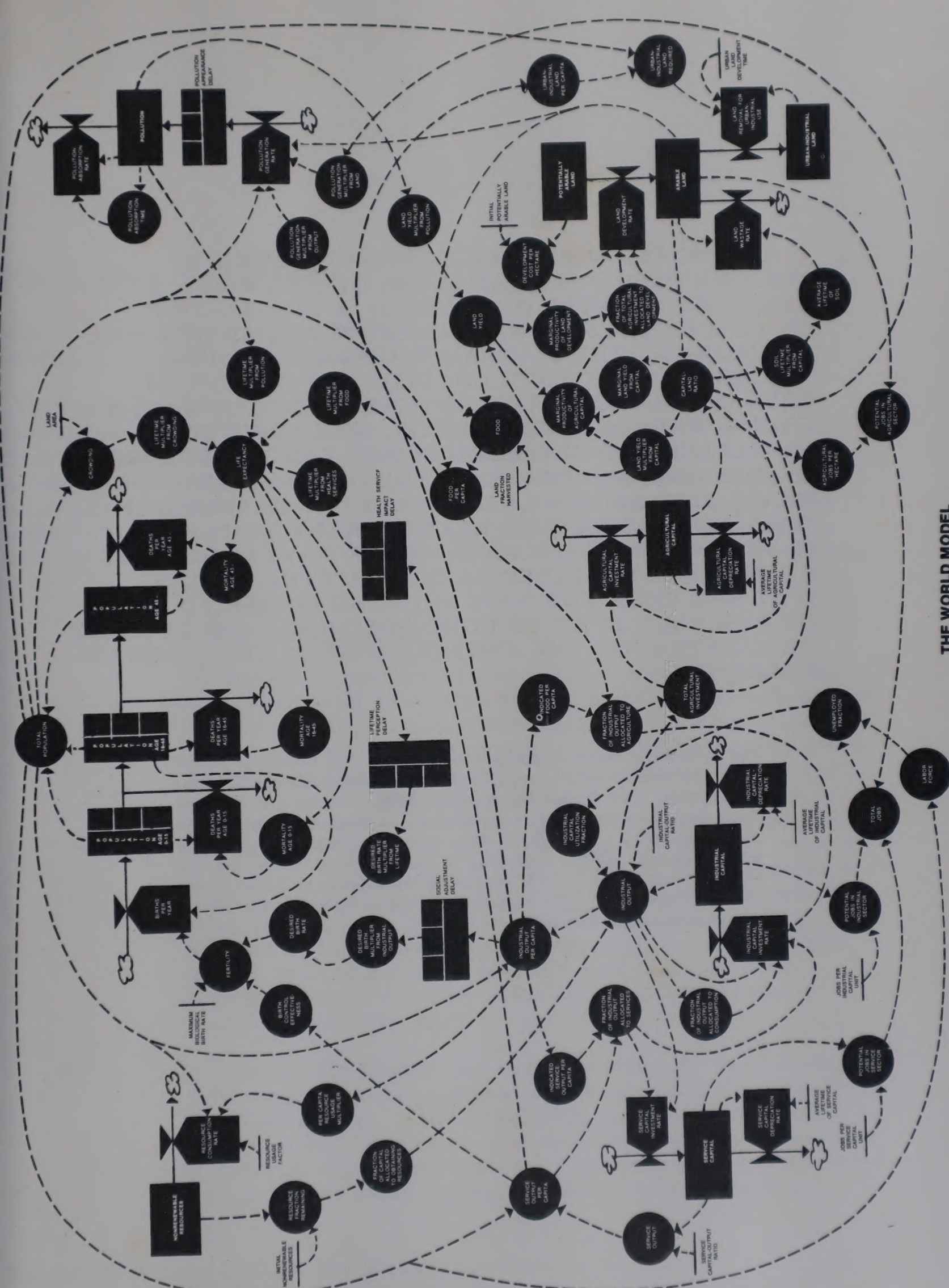
- MARKETING AS A TOOL OF DEVELOPMENT 55
Frank Meissner
- GOVERNMENT SERVICES FOR 57
AGRICULTURAL MARKETING
Hans Mittendorf
- VOLUNTARY CHAINS OF RETAIL FOOD 64
STORES IN LATIN AMERICA
C. Guthrie
- AGRIBUSINESS AND LATIN AMERICAN 74
DEVELOPMENT IN THE SEVENTIES
Antonio Ortiz Mena

COMMUNICATIONS MEDIA

- COMMUNICATION IN DEVELOPMENT 83
Everett M. Rogers
- TELEVISION PROGRAMMING IN DAKAR 90
Staff of the United Nations Educational, Scientific
and Cultural Organization (UNESCO)

EDUCATIONAL RADIO IN SENEGAL Henry R. Cassirer	103
TELEVISION AND EDUCATIONAL REFORM Wilbur Schramm	108
INDEX - VOLUME XII, 1974	125

(Unless otherwise indicated,
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THE WORLD MODEL

LIMITS TO GROWTH?

THE WORLD MODEL PICTURED ON PAGE 1 IS THE ONE USED IN THE ANALYSIS OF THE FIRST ARTICLE ON LIMITS TO GROWTH; A DESCRIPTION OF HOW THE MODEL WAS CONSTRUCTED BEGINS ON PAGE 12. THE DIAGRAM SHOWS ALL OF THE VARIABLES THAT ENTERED INTO THE COMPUTERIZED CALCULATIONS OF FUTURE TRENDS IN WORLD PRODUCTION AND POPULATION, INCLUDING SOME VARIABLES NOT DISCUSSED IN THE TEXT. BECAUSE OF THE SIZE AND SHAPE OF THE DIAGRAM AND THE SMALL SIZE OF THE LETTERS USED IN IT, THE EDITORS DECIDED RATHER RELUCTANTLY TO PLACE IT SIDE WAYS ON THE PAGE, SINCE IT WOULD HAVE BEEN ALMOST IMPOSSIBLE TO READ THE WRITING IF IT HAD BEEN FURTHER REDUCED IN SIZE TO FIT ON THE PAGE IN AN UPRIGHT POSITION. THE AUTHORS' DESCRIPTION OF THE SYMBOLS USED IN THE DIAGRAM FOLLOWS.

The entire world model is represented here by a flow diagram in formal System Dynamics notation. Levels, or physical quantities that can be measured directly, are indicated by rectangles , rates that influence those levels by valves , and auxiliary variables that influence the rate equations by circles . Time delays are indicated by sections within rectangles . Real flows of people, goods, money, etc. are shown by solid arrows  and causal relationships by broken arrows . Clouds  represent sources or sinks that are not important to the model behavior.

The Limits To Growth

MIT International Project Team
Dennis L. Meadows, Director

[This report grew out of a Project on the Predicament of Mankind sponsored by the Club of Rome, an international group of scholars, civil servants and business leaders. Using a computer model of variables affecting world growth, researchers conclude that current economic growth trends will meet intractable limits within the next century. To avert an international catastrophe, restraints on population growth and the use of nonrenewable resources will be necessary.

Problems and Models

Decision-makers at every level unconsciously use mental models to choose among policies that will shape our future world. These mental models are, of necessity, very simple when compared with the reality from which they are abstracted. The human brain can only keep track of a limited number of the complicated, simultaneous interactions that determine the nature of the real world. We, too, have used a model. Ours is a formal, written model of the world. It constitutes a preliminary attempt to improve our mental models of long-term global problems by combining the large amount of information that is already in human minds and in written records with the new information-processing tools — the scientific method, systems analysis, and the modern computer.

Our world model was built specifically to investigate five major trends of global concern — accelerating industrialization, rapid population growth, widespread malnutrition, depletion of nonrenewable resources, and a deteriorating environment. These trends are all interconnected in many ways, and their development is

The project team was at the Massachusetts Institute of Technology, Cambridge, Mass.

measured in decades or centuries, rather than in months or years. With the model we are seeking to understand the causes of these trends, their interrelationships, and their implications as much as one hundred years in the future. The model we have constructed is, like every other model, imperfect, oversimplified, and unfinished. We are well aware of its shortcomings, but we believe that it is the most useful model now available for dealing with problems far out on the space-time graph.

It is not our purpose here to give a complete, scientific description of all the data and mathematical equations included in the world model. Such a description can be found in the final technical report of our project. Rather, in The Limits to Growth we summarize the main features of the model and our findings in a nontechnical way. The emphasis is meant to be not on the equations or the intricacies of the model, but on what it tells us about the world. We have used a computer as a tool to aid our own understanding of the causes and consequences of the accelerating trends that characterize the modern world, but familiarity with computers is by no means necessary to comprehend or to discuss our conclusions. The implications of those accelerating trends raise issues that must be debated by a wider community than that of scientists alone. Our purpose here is to open that debate.

The conclusions we have drawn from our work with the model are:

1. If the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity.
2. It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realize his individual human potential.
3. If the world's people decide to strive for this second outcome rather than the first, the sooner they begin working to attain it, the greater will be their chances of success.

The Nature of Exponential Growth

Most people are accustomed to thinking of growth as a linear process. For example, a child who becomes one inch taller each year is growing linearly. The amount of increase each year is not affected by the size of the child. A quantity exhibits exponential growth when it increases by a constant percentage of the whole in a constant time period. A colony of yeast cells in which each cell divides into two cells every 10 minutes is growing exponentially. For each single cell, after ten minutes

there will be two cells, an increase of 100 percent. After the next 10 minutes there will be four cells, then eight, then sixteen.

Common as it is, exponential growth can yield surprisingly results. There is an old Persian legend about a clever courtier who presented a beautiful chessboard to his king and requested that the king give him in return 1 grain of rice for the first square on the board, 2 grains for the second square, 4 grains for the third, and so forth. The king readily agreed and ordered rice to be brought from his stores. The fourth square of the chessboard required 8 grains, the tenth square 512 grains, the fifteenth required 16,384, and the twenty-first square gave the courtier more than a million grains of rice. The king's entire rice supply was exhausted long before he reached the sixty-fourth square. Exponential increase is deceptive because it generates immense numbers very quickly.

It is useful to think of exponential growth in terms of doubling time, or the time it takes a growing quantity to double in size. A French riddle for children illustrates this aspect of exponential growth — the apparent suddenness with which it approaches a fixed limit. Suppose you own a pond on which a water lily is growing. The lily plant doubles in size each day. If the lily were allowed to grow unchecked, it would completely cover the pond in 30 days, choking off the other forms of life in the water. For a long time the lily plant seems small, and so you decide not to worry about cutting it back until it covers half the pond. On what day will that be? On the twenty-ninth day, of course. You have one day to save your pond.

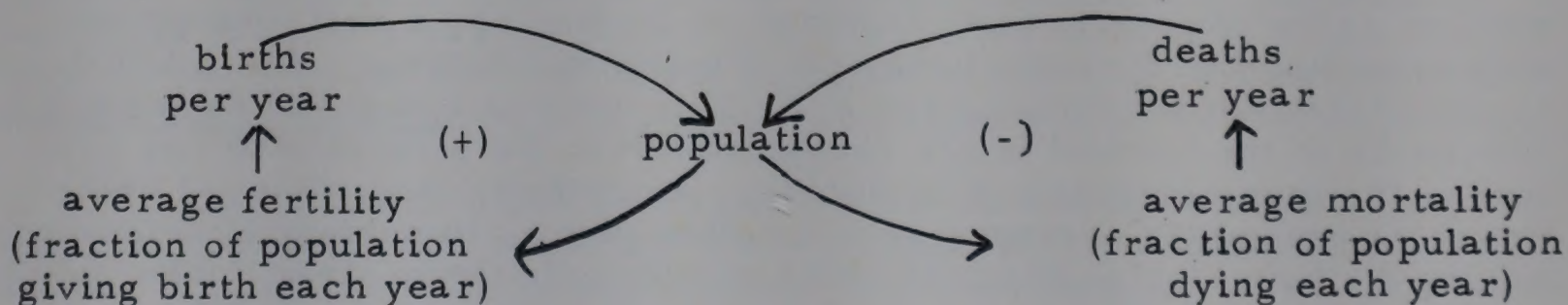
Models and exponential growth. Over the last 30 years there has evolved at the Massachusetts Institute of Technology a new method for understanding the dynamic behavior of complex systems. The method is called System Dynamics [See J. W. Forrester's Industrial Dynamcis.] The basis of the method is the recognition that the structure of any system — the many circular, interlocking, sometimes time-delayed relationships among its components — is often just as important in determining its behavior as the individual components themselves. The world model described in this book is a System Dynamics model.

Dynamic modeling theory indicates that any exponentially growing quantity is somehow involved with a positive feedback loop. An example is the familiar wage-price spiral — wages increase, which causes prices to increase, which leads to demands for higher wages, and so forth. In a positive feedback loop a chain of cause-and-effect relationships closes on itself, so that increasing any one element in the loop will start a sequence of changes that will result in the originally changed element being increased even more. We can begin our dynamic analysis of the long-term world situation by looking for the positive feedback loops, underlying the exponential growth in the five physical quantities we have already mentioned. In particular, the growth rates of two of these elements — population and industrialization — are of

interest, since the goal of many development policies is to encourage the growth of the latter relative to the former.

World population growth. In 1650 the population numbered about 0.5 billion, and it was growing at a rate of approximately 0.3 percent per year. That corresponds to a doubling time of nearly 250 years. In 1970 the population totaled 3.6 billion and the rate of growth was 2.1 percent per year. The doubling time at this growth rate is 33 years. Thus, not only has the population been growing exponentially, but the rate of growth has also been growing: the population curve is rising even faster than it would if growth were strictly exponential.

The feedback loop structure that represents the dynamic behavior of population growth is shown below. On the left is the positive feedback loop that accounts for the observed exponential growth. In a population with constant average fertility, the larger the population, the more babies will be born each year. The more babies, the larger the population will be the following year. After a delay to allow those babies to grow up and become parents, even more babies will be born, swelling the population still further. If, in addition to sons, each woman has on the average two female children, for example, and each of them grows up to have two more female children, the population will double each generation. The growth rate will depend on both the average fertility and the length of the delay between generations.

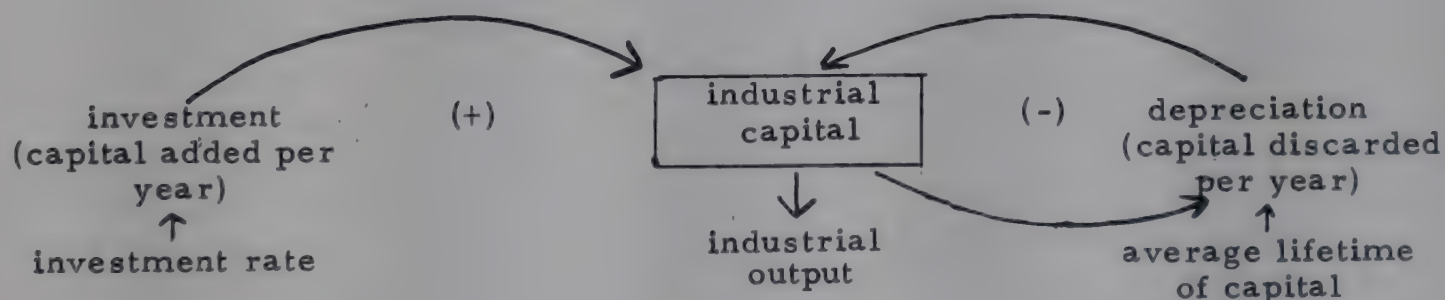


There is another feedback loop governing population growth, shown on the right side of the diagram. It is a negative feedback loop. Whereas positive feedback loops generate runaway growth, negative feedback loops tend to regulate growth and to hold a system in some stable state. The negative feedback loop controlling population is based upon average mortality, a reflection of the general health of the population. The number of deaths each year is equal to the total population times the average mortality (which we might think of as the average probability of death at any age). An increase in the size of a population with constant average mortality will result in more deaths per year. If there were no deaths in a population, it would grow exponentially by the positive feedback loop of births. If there were no births, the population would decline to zero

because of the negative feedback loop of deaths. Since every real population experiences both births and deaths, as well as varying fertility and mortality, the dynamic behavior of populations governed by these two interlocking feedback loops can become fairly complicated.

What about the population of the future? For the moment we can safely conclude that because of the delays in the controlling feedback loops, especially the positive loop of births, there is no possibility of leveling off the population growth curve before the year 2000, even with the most optimistic assumption of decreasing fertility. Most of the prospective parents of the year 2000 have already been born. Unless there is a sharp rise in mortality, which mankind will certainly strive mightily to avoid, we can look forward to a world population of around 7 billion persons in 30 more years. And if we continue to succeed in lowering mortality with no better success in lowering fertility than we have accomplished in the past, in 60 years there will be four people in the world for every one person living today.

World economic growth. A second quantity that has been increasing in the world even faster than human population is industrial output. The average growth rate from 1963 to 1968 was 7 percent per year, or 5 percent per year on a per capita basis. What is the positive feedback loop that accounts for exponential growth of industrial output? The dynamic structure, diagramed below, is very similar to the one described for the population system.



With a given amount of industrial capital (factories, trucks, tools, machines, etc.), a certain amount of manufactured output each year is possible. The output actually produced is also dependent on labor, raw materials, and other inputs. For the moment we will assume that these other inputs are sufficient, so that capital is the limiting factor in production. Much of each year's output is consumable goods, such as textiles, automobiles, and houses, that leave the industrial system. But some fraction of the production is more capital — looms, steel mills, lathes — which is an investment to increase the capital stock. Here we have another positive feedback loop. More capital creates more output, some variable fraction of the output is investment, and more investment means more capital. The new larger capital stock generates even more output, and so on. There are also delays in this

feedback loop, since the production of a major piece of industrial capital, such as an electrical generating plant or a refinery, can take several years.

Capital stock is not permanent. As capital wears out or becomes obsolete, it is discarded. To model this situation we must introduce into the capital system a negative feedback loop accounting for capital depreciation. The more capital there is, the more wears out on the average each year; and the more that wears out, the less there will be the next year. This negative feedback loop is exactly analogous to the death rate loop in the population system. As in the population system, the positive loop is strongly dominant in the world today, and the world's industrial capital stock is growing exponentially.

Since industrial output is growing at 7 percent per year and population only at 2 percent per year, it might appear that dominant positive feedback loops are a cause for rejoicing. Simple extrapolation of those growth rates would suggest that the material standard of living of the world's people will double within the next 14 years. Such a conclusion, however, often includes the implicit assumption the world's growing industrial output is evenly distributed among the world's citizens. But most of the world's industrial growth taking place in the already industrial countries, where the rate of population growth is comparatively low.

The Limits To Exponential Growth

What will be needed to sustain world economic and population growth until and beyond the year 2000? The list of necessary ingredients can be divided into two main categories. The first category includes the physical necessities that support all physiological and industrial activity — food, raw materials, fossil and nuclear fuels, and the ecological systems of the planet which absorb wastes and recycle important basic chemical substances. These ingredients are in principle tangible, countable items, such as arable land, fresh water, metals, forests, the oceans. The second category consists of the social necessities. The actual growth of the economy and of the population will depend on such factors as peace and social stability, education and employment, and steady technological progress. These factors are much more difficult to assess or to predict. Our world model at this stage in its development cannot deal explicitly with these social factors. Let us assume for the moment that the best possible social conditions will prevail. How much growth will the physical system then support? The answer we obtain will give us some estimate of the upper limits to population and capital growth, but no guarantee that growth will actually proceed that far.

Food. No one knows exactly how many of the world's people are inadequately nourished today, but there is general agreement that the number is large -- perhaps 50 to 60 percent of the population of the less industrialized countries, which means one third of the population of the world. Estimates by the UN Food and Agriculture Organization (FAO)

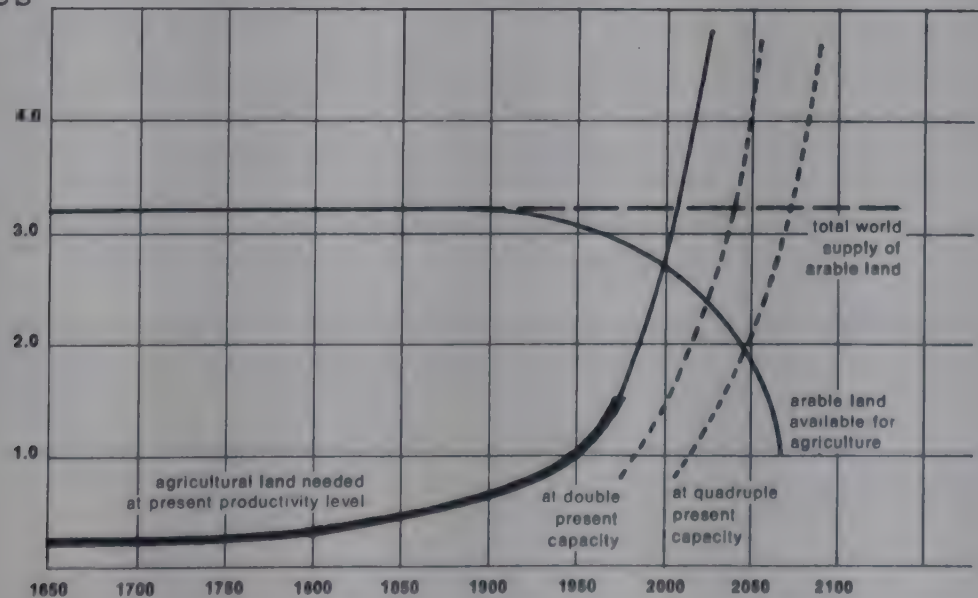
indicate that in most of the developing countries basic caloric requirements, and particularly protein requirements, are not being supplied. Furthermore, although total world agricultural production is increasing, food production per capita in the nonindustrialized countries is barely holding constant at its present inadequate level. Do these rather dismal statistics mean that the limits of food production on the earth have already been reached?

The primary resource necessary for producing food is land. Recent studies indicate that there are, at most, about 3.2 billion hectares of land (7.86 billion acres) potentially suitable for agriculture on the earth. Approximately half of that land, the richest, most accessible half, is under cultivation today. The remaining land will require immense capital inputs to reach, clear, irrigate, or fertilize before it is ready to produce food. Recent costs of developing new land have ranged from \$215 to \$5,275 per hectare. Average cost for opening land in unsettled areas has been \$1,150 per hectare.

If the world's people did decide to pay the high capital costs, to cultivate all possible arable land, and to produce as much food as possible, how many people could theoretically be fed? The lower curve in figure 1 shows the amount of land needed to feed the growing world population, assuming that the present world average of 0.4 hectares per person is sufficient. (To feed the entire world population at present U.S. standards, 0.9 hectares per person would be required.) The upper curve in figure 1 shows the actual amount of arable land available over time. This line slopes downward because each additional person requires a certain amount of land (0.08 hectares per person assumed here) for housing, roads, waste disposal, power lines, and other uses that make it unusable for food production. Figure 1 shows that, even with the optimistic assumption that all possible land is utilized, there will still be a desperate land shortage before the year 2000 if per capita land requirements and population growth rates remain as they are today.

Figure 1 ARABLE LAND

billion hectares



Total world supply of arable land is about 3.2 billion hectares. About 0.4 hectares per person of arable land are needed at present productivity. The curve of land needed thus reflects the population growth curve. The light line after 1970 shows the projected need for land, assuming that world population continues to grow at its present rate. Arable land available decreases because arable land is removed for urban-industrial use as population grows. The dotted curves show land needed if present productivity is doubled or quadrupled.

Figure 1 illustrates some important general facts about exponential growth within a limited space. First, it shows how one can move within a very few years from a situation of great abundance to one of great scarcity. There has been an overwhelming excess of potentially arable land for all of history, and now, within 30 years (or about one population doubling time), there may be a sudden and serious shortage. A second lesson is that precise numerical assumptions about the limits of the earth are unimportant when viewed against the inexorable progress of exponential growth. We might assume, for example, that no arable land is taken for cities, roads, or other nonagricultural uses. In that case, the land available is constant, as shown by the horizontal dashed line. The point at which the two curves cross is delayed by about 10 years. Or we can suppose that it is possible to double, or even quadruple, the productivity of the land through advances in agricultural technology and investments in capital, such as tractors, fertilizers, and irrigation systems. The effects of two different assumptions about increased productivity are shown by the dotted lines in figure 1. Each doubling of productivity gains about 30 years, or less than one population doubling time.

Of course, society will not be suddenly surprised by the "crisis point" at which the amount of land needed becomes greater than that available. Symptoms of the crisis will begin to appear long before the crisis point is reached. Food prices will rise so high that some people will starve; others will be forced to decrease the effective amount of land they use and shift to lower quality diets. These symptoms are already apparent in many parts of the world.

If society did decide to pay the necessary costs to gain new land or to increase productivity of the land already cultivated, figure 1 shows how quickly rising population would bring about another "crisis point." And each successive crisis point will cost more to overcome. Each doubling of yield from the land will be more expensive than the last one. We might call this phenomenon the law of increasing costs. The best and most sobering example of that law comes from an assessment of the cost of past agricultural gains. To achieve a 34 percent increase in world food production from 1951 to 1966, agriculturalists increased yearly expenditures on tractors by 63 percent, annual investment in nitrate fertilizers by 146 percent, and annual use of pesticides by 300 percent. The next 34 percent increase will require even greater inputs of capital and resources.

How many people can be fed on this earth? There is, of course, no simple answer to this question. The answer depends on the choices society makes among various available alternatives. There is a direct trade-off between producing more food and producing other goods and services needed or desired by mankind. The demand for these other goods and services is also increasing as population grows, and therefore the trade-off becomes continuously more apparent and more difficult to resolve. Even if the choice were consistently to produce food as the first priority, however, continued population growth and the law of increasing costs could rapidly drive the system to the point where all available resources were devoted to producing food, leaving no further possibility of expansion.

In this section we have discussed only one possible limit to food production — arable land. There are other possible limits. The most obvious one, second in importance only to land, is the availability of fresh water. There is an upper limit to the fresh water runoff from the land areas of the earth each year, and there is also an exponentially increasing demand for that water. We could draw a graph exactly analogous to figure 1 to show the approach of the increasing demand curve for water to the constant average supply. In some areas of the world, this limit will be reached long before the land limit becomes apparent.

It is also possible to avoid or extend these limits by technological advances that remove dependence on the land (synthetic food) or that create new sources of fresh water (desalinization of sea water), but no new technology is spontaneous or without cost. The factories and raw materials to produce synthetic food, the equipment and energy to purify sea water must all come from the physical world system.

The exponential growth of demand for food results directly from the positive feedback loop that is now determining the growth of human population. The supply of food to be expected in the future is dependent on land and fresh water and also on agricultural capital, which depends in turn on the other dominant positive feedback loop in the system — the capital investment loop. Opening new land, farming the sea, or expanding use of fertilizers and pesticides will require an increase of the capital stock devoted to food production. The resources that permit growth of that capital stock tend not to be renewable resources, like land or water, but nonrenewable resources, like fuels or metals. Thus the expansion of food production in the future is very dependent on the availability of nonrenewable resources. Are there limits to the earth's supply of these resources?

Nonrenewable resources. In 1970 the first annual report of the Council on Environmental Protection declared,

"Even taking into account such economic factors as increased prices with decreasing availability, it would appear at present that the quantities of platinum, gold,

zinc, and lead are not sufficient to meet demands. At the present rate of expansion... silver, tin, and uranium may be in short supply even at higher prices by the turn of the century. By the year 2050, several more minerals may be exhausted if the current rate of consumption continues. Despite spectacular recent discoveries, there are only a limited number of places left to search for most minerals. Geologists disagree about the prospects for finding large, new, rich ore deposits. Reliance on such discoveries would seem unwise in the long term."

Table 1: Some Nonrenewable Natural Resources

	Known Global Reserves	Static Index in years	Projected Annual Growth Rates	Exponential Index in years	Exponential Index with 5 times Reserves
Aluminum	1.17×10^9 tons	100	6.4%	31	55
Chromium	7.75×10^8 tons	420	2.6%	95	154
Coal	5×10^{12} tons	2300	4.1%	111	150
Copper	308×10^6 tons	36	4.6%	21	48
Iron	1×10^{11} tons	240	1.8%	93	173
Lead	91×10^6 tons	26	2.0%	21	64
Manganese	8×10^6 tons	97	2.9%	46	94
Natural Gas	1.14×10^{13} cu. ft.	38	4.7%	22	49
Nickel	147×10^9 lbs.	150	3.4%	53	96
Petroleum	455×10^9 bbls.	31	3.9%	20	50
Silver	5.5×10^9 oz.	16	2.7%	13	42
Tin	4.3×10^6 tons.	17	1.1%	15	61

Source: U. S. Bureau of Mines

Table 1 lists some of the more important mineral and fuel resources, the vital raw materials for today's major industrial processes. The number following each resource in column 2 is the static reserve index, or the number of years present known reserves of that resource will last at the current rate of usage. But column 3 shows that the world usage rate of every natural resource is growing exponentially. For many resources

the usage rate is growing even faster than the population, indicating that more people are consuming resources each year and also that the average consumption per person is increasing each year.

We have already seen in figure 1 that an exponential increase in land use can very quickly run up against the fixed amount of land available. An exponential increase in resource consumption can rapidly diminish a fixed store of resources in the same way. The example in this case is chromium ore, chosen because it has one of the longest static reserve indices of all the resources listed in table 1. The world's known reserves of chromium are about 775 million metric tons, of which about 1.85 million metric tons are mined annually at present. Thus, at the current rate of use, the known reserves would last about 420 years. The actual world consumption of chromium is increasing, however, at the rate of 2.6 percent annually. That growth rate, if it continues, will deplete the resource stock, not in 420 years as the linear assumption indicates, but in just 95 years. If we suppose that reserves yet undiscovered could increase present known reserves by a factor of five, this fivefold increase would extend the lifetime of the reserves only from 95 to 154 years. And even if it were possible from 1970 onward to recycle 100 percent of the chromium so that none of the initial reserves were lost, the demand would exceed the supply in 235 years.

The earth's crust contains vast amounts of raw materials, but however vast those amounts may be, they are not infinite. Now that we have seen how suddenly an exponentially growing quantity approaches a fixed upper limit, the following statement should not come as a surprise. Given present resource consumption rates and the projected increase in these rates, the great majority of the currently important nonrenewable resources will be extremely costly 100 years from now. The above statement remains true regardless of the most optimistic assumptions about undiscovered reserves, technological advances, substitution, or recycling, as long as the demand for resources continues to grow exponentially. The prices of those resources with the shortest static reserve indices have already begun to increase. The price of mercury, for example, has gone up 500 percent in the last 20 years; the price of lead has increased 300 percent in the last 30 years.

Are there enough resources to allow the economic development of the 7 billion people expected by the year 2000 to a reasonably high standard of living? It depends on how the major resource-consuming societies handle some important decisions ahead. They might continue to increase resource consumption according to the present pattern. They might learn to reclaim and recycle discarded materials. They might develop new designs to increase the durability of products made from scarce resources. They might encourage social and economic patterns that would satisfy the needs of a person while minimizing, rather than maximizing, the irreplaceable substances he possesses and disperses.

What happens to the metals and fuels extracted from the earth after they have been used and discarded? In one sense they are never lost. Their constituent atoms are rearranged and eventually dispersed in a diluted and unusable form into the air, the soil, and the waters of our planet. The natural ecological systems can absorb many of the effluents of human activity and reprocess them into substances that are usable by, or at least harmless to other forms of life. When effluents are released on a large enough scale, however, the natural absorptive mechanisms can become saturated. The wastes of human civilization can build up in the environment until they become visible, annoying, and even harmful. It is little wonder, then, that another exponentially increasing quantity in the world system is pollution.

Pollution. Concern for the effect of industrial activities on the natural environment is only very recent. Scientific attempts to measure this effect are even more recent and still very incomplete. We are certainly not able, at this time, to come to any final conclusion about the earth's capacity to absorb pollution. We can, however, make four basic points: 1. The few kinds of pollution that have been measured over time seem to be increasing exponentially. 2. We have almost no knowledge about where the upper limits to these pollution growth curves might be. 3. The presence of natural delays in ecological processes increases the probability of underestimating the control measures necessary, and therefore of inadvertently reaching those upper limits. 4. Many pollutants are globally distributed; their harmful effects appear long distances from their points of generation.

Growth in the World System

We have discussed food, nonrenewable resources, and pollution absorption as separate factors necessary for the growth and maintenance of population and industry. We have looked at the rate of growth in the demand for each of these factors and at the possible upper limits to the supply. By making simple extrapolations of the demand growth curves, we have attempted to estimate, roughly, how much longer growth of each of these factors might continue at its present rate of increase. Our conclusion from these extrapolations is that the short doubling times of many of man's activities, combined with the immense quantities being doubled, will bring us close to the limits to growth of those activities surprisingly soon. Furthermore, over long time periods each of these factors also feeds back to influence itself. The rate at which food production increases in the 1970s, for example, will have some effect on the size of the population in the 1980s, which will in turn determine the rate at which food production must increase for many years thereafter. Similarly, the rate of resource consumption in the next few years will influence both the size of the capital base that must be maintained and the amount of resources left in the earth. Existing capital and available resources will then interact to determine future resource supply and demand.

We will now describe the formal world model that we have used as a first step toward comprehending this complex world system. The model is an attempt to bring together the large body of knowledge that already exists about cause-and-effect relationships among the five elements and to express that knowledge in terms of interlocking feedback loops.

In constructing the model, we followed four main steps:

1. We first listed the important causal relationships among the five elements and traced the feedback loop structure. To do so we consulted literature and professionals in many fields of study dealing with the areas of concern — demography, economics, agronomy, nutrition, geology and ecology, for example. Our goal in this first step was to find the most basic structure that would reflect the major interactions between the five elements. We reasoned that elaborations on this basic structure, reflecting more detailed knowledge, could be added after the simple system was understood.

2. We then quantified each relationship as accurately as possible, using global data where it was available and characteristic local data where global measurements had not been made.

3. With the computer, we calculated the simultaneous operation of all these relationships over time. We then tested the effect of numerical changes in the basic assumptions to find the most critical determinants of the system's behavior.

4. Finally, we tested the effect on our global system of the various policies that are currently being proposed to enhance or change the behavior of the system.

In this first simple world model, we are interested only in the broad behavior modes of the population-capital system. By behavior modes we mean the tendencies of the variables in the system (population, pollution, etc.) to change over time. A variable may increase, decrease remain constant, oscillate, or combine several of these characteristic modes. For example, a population growing in a limited environment can approach the ultimate carrying capacity of that environment in several possible ways. It can adjust smoothly to an equilibrium below the environmental limit by means of a gradual decrease in growth rate. It can overshoot the limit and then die back again, in either a smooth or an oscillatory way. Or it can overshoot the limit and in the process decrease the ultimate carrying capacity by consuming some necessary nonrenewable resource.

A major purpose in constructing the world model has been to determine which, if any, of these behavior modes will be most characteristic of the world system as it reaches the limits to growth. The output graphs

reproduced later in this book show values for world population, capital, and other variables on a time scale that begins in the year 1900 and continues until 2100. These graphs are not exact predictions of the values of the variables at any particular year in the future. They are indications of the system's behavioral tendencies only.

Because we are interested at this point only in broad behavior modes, this first world model is not extremely detailed. We consider only one general population, a population that statistically reflects the average characteristics of the global population. We include only one class of pollutants — the long-lived, globally distributed family of pollutants, such as lead, mercury, asbestos, and stable pesticides and radioisotopes — whose dynamic behavior in the eco-system we are beginning to understand. We plot one generalized resource that represents the combined reserves of all nonrenewable resources, although we know that each separate resource will follow the general dynamic pattern at its own specific level and rate.

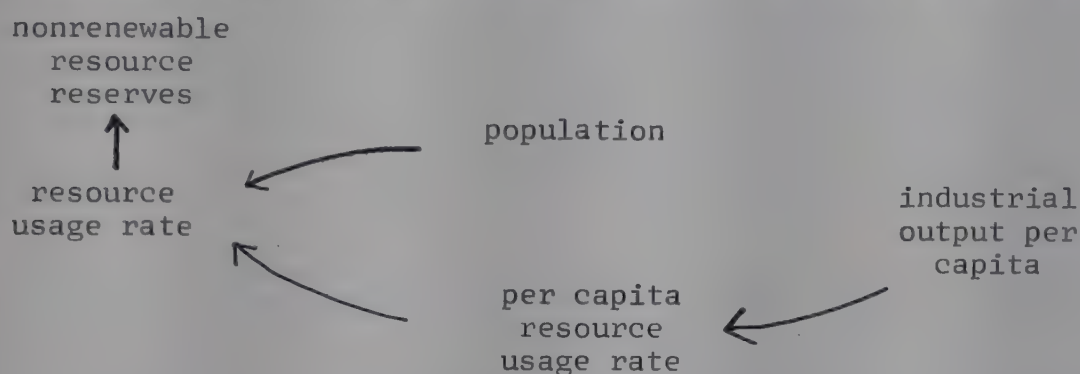
This high level of aggregation is necessary at this point to keep the model understandable. At the same time it limits the information we can expect to gain from the model. Questions of detail cannot be answered because the model simply does not yet contain much detail. National boundaries are not recognized. Distribution inequalities of food, resources, and capital are included implicitly in the data but they are not calculated explicitly nor graphed in the output. World trade balances, migration patterns, climatic determinants, and political processes are not specifically treated. Other models can, and we hope will, be built to clarify the behavior of these important subsystems.

The complete flow diagram for the world model, incorporating all these factors and more, is shown in the diagram on page 1. Each of the arrows represents a general relationship that we know is important or potentially important in the population-capital system. The structure is, in fact, sufficiently general that it might also represent a single nation or even a single city. To apply the model structure to a nation, we would quantify each relationship in the structure with numbers characteristic of that nation. To represent the world, the data would have to reflect average characteristics of the whole world.

Most of the causal influences in the real world are nonlinear. That is, a certain change in a causal variable may affect another variable differently depending on the point within the possible range of the second variable at which the change takes place. For instance, if an increase in food per capita of 10 percent has been shown to increase life expectancy by 10 years, it may not follow that an increase of food per capita by 20 percent will increase life expectancy by 20 years. The current state of knowledge about causal relationships in the world ranges from complete ignorance to extreme accuracy. The relationships in the world model generally fall in the middle ground of certainty. We do know something

about the direction and magnitude of the causal effects, but we rarely have fully accurate information about them. To illustrate how we operate on this intermediate ground of knowledge, we present here three examples of quantitative relationships from the world model.

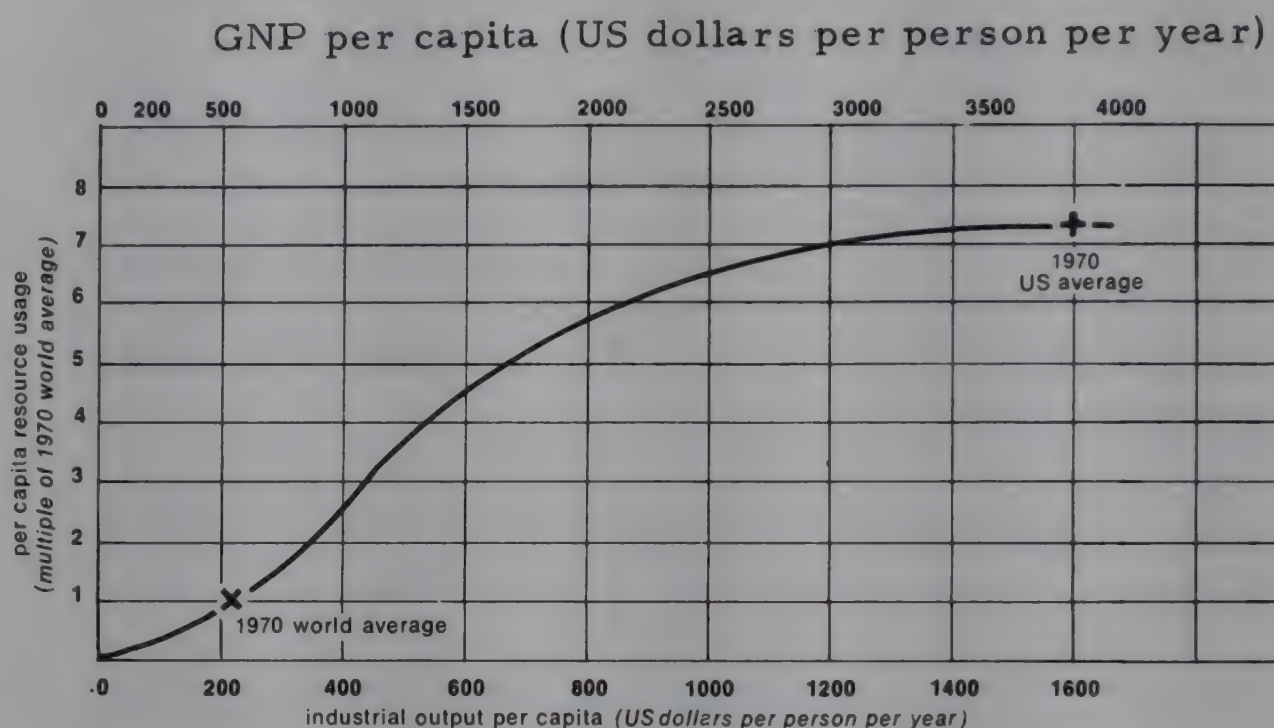
Per capita resource use. As the world's population and capital grow, what will happen to the demand for nonrenewable resources? The amount of resources consumed each year can be found by multiplying the population times the per capita resource usage rate. As a population becomes more wealthy, it tends to consume more resources per person per year. The flow diagram expressing the relationship of population, per capita resource usage rate, and wealth (as measured by industrial output per capita) to the resource usage rate is shown below.



The relationship between wealth (industrial output per capita) and resource demand (per capita resource usage rate) is expressed by a non-linear curve of the form shown in figure 2. Resource use is defined in terms of the world average resource consumption per capita in 1970, which is set equal to 1. Since world average industrial output per capita in 1970 was about \$230, we know that the curve goes through the point marked by an X. In 1970 the United States had an average industrial output per capita of about \$1,600, and the average citizen consumed approximately seven times the world average per capita resource usage. The point on the curve that would represent the U.S. level of consumption is marked by a +. We assume that, as the rest of the world develops economically, it will follow basically the U.S. pattern of consumption — a sharp upward curve as output per capita grows, followed by a leveling off. The final plateau represents an average saturation level of material possessions. Further income increases are spent primarily on services, which are less resource consuming.

Desired birth rate. The number of births per year in any population equals the number of women of reproductive age times the average fertility (the average number of births per women per year). The maximum biological birth rate is the rate at which women would bear children if they practiced no method of birth control throughout their entire reproductive lifetimes. This rate is biologically determined, depending mainly on the general health of the population. The desired birth rate is the rate that would result if the population practiced "perfect" birth control and had only planned and wanted children. Birth control effectiveness measures the extent to which the population is able to achieve the desired birth rate rather than the maximum biological one.

Figure 2 INDUSTRIAL OUTPUT PER CAPITA AND RESOURCE USAGE



The postulated model relationship between resources consumed per person and industrial output per person is S-shaped. In nonindustrialized societies resource consumption is very low, since most production is agricultural. As industrialization increases, nonrenewable resource consumption rises steeply, and then becomes nearly level at a very high rate of consumption. Point X indicates the 1970 world average resource consumption; point + indicates the 1970 US average consumption rate. The two horizontal scales give the resource consumption relationship in terms of both industrial output per capita and GNP per capita.

The relation between crude birth rates and GNP per capita of all the nations in the world follows a surprisingly regular pattern. In general, as GNP rises, the birth rate falls. This appears to be true despite difference in religious, cultural, or political factors. Apparently a number of changes that lower the birth rate are associated with industrialization. Most evidence would indicate that this relationship does not operate through the maximum biological birth rate. If anything, rising industrialization implies better health, so that the number of births possible might increase as GNP increases. On the other hand, birth control effectiveness would also increase, and this effect certainly contributes to the decline in births. We suggest, however, that the major effect of rising GNP is on the desired birth rate. The desired birth rate falls sharply as per capita industrial output increases, and then it stabilizes and turns upward slightly at high output levels. This upturn is based on higher levels of desired births in the richest US families.

Pollution effect on lifetime. We have included in the world model the possibility that pollution will influence the life expectancy of the world's

population. There are only meager global data on the effect of pollution on life expectancy. Information is slowly becoming available about the toxicity to humans of specific pollutants, such as mercury and lead. Attempts to relate statistically a given concentration of pollutant to the mortality of a population have been made only in the field of air pollution.

Although quantitative evidence is not yet available, there is little doubt that a relationship does indeed exist between pollution and human health. We would be more in error to ignore the influence of pollution on life expectancy in the world model than to include it with our best guess of its magnitude. We can expect that the relationship between pollution and lifetime is negative, although we do not know what the exact shape or slope of a curve expressing it will be. The one we believe most accurately depicts the relationship between life expectancy and pollution assumes that an increase in global pollution by a factor of 10 would have almost no effect on lifetime, but an increase by a factor of 100 would have a great effect.

The relationships discussed above are only three of the hundred or so causal links that make up the world model. In many cases the information available is not complete. Nevertheless, we believe that the model based on this information is useful even at this preliminary stage for several reasons. First, we hope that by posing each relationship as a hypothesis, and emphasizing its importance in the total world system, we may generate discussion and research that will eventually improve the data we have to work with. Second, even in the absence of improved data, information now available is sufficient to generate valid basic behavior modes for the world system. This is true because the model's feedback loop structure is a much more important determinant of overall behavior than the exact numbers used to quantify the feedback loops. Even rather large changes in input data do not generally alter the mode of behavior, as we shall see in the following pages. Numerical changes may well affect the period of an oscillation or the rate of growth or the time of a collapse, but they will not affect the fact that the basic mode is oscillation or growth or collapse. Third, if decision-makers at any level had access to precise predictions and scientifically correct analyses of alternate policies, we would certainly not bother to construct or publish a simulation model based on partial knowledge. Unfortunately, there is no perfect model available for use in evaluating today's important policy issues. At the moment, our only alternatives to a model like this, based on partial knowledge, are mental models, based on the mixture of incomplete information and intuition that currently lies behind most political decisions.

World Model Behavior

As the world system grows toward its ultimate limits, what will be its most likely behavior mode? What relationships now existent will change as the exponential growth curves level off? What will the world be like when growth comes to an end?

Let us begin by assuming that there will be in the future no great changes in human values nor in the functioning of the global population-capital system as it has operated for the last one hundred years. The results of this assumption are shown in figure 3. We shall refer to this computer output as the "standard run" and use it for comparison with the runs based on other assumptions that follow. The horizontal scale in figure 3 shows time in years from 1900 to 2100. With the computer we have plotted the progress over time of eight quantities:

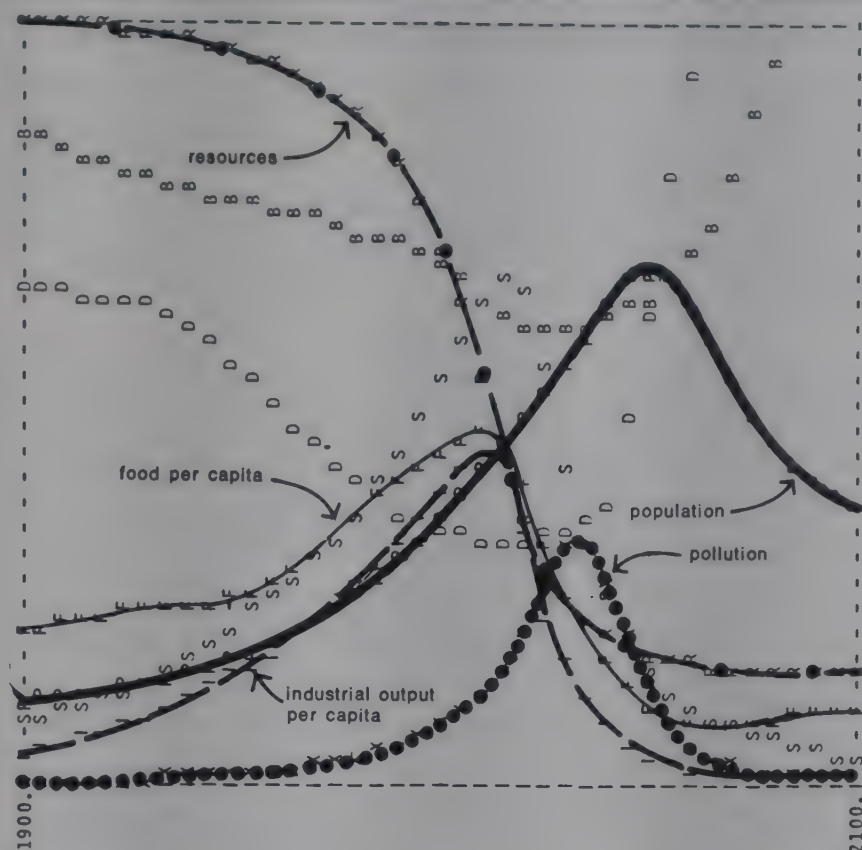
_____	Population (total number of persons)
- - - -	Industrial output per capita (dollar equivalent per person per year)
_____	Food per capita (kilogram-grain equivalent per person per year)
-o-o-	Pollution (multiple of 1970 level)
ooooo	Nonrenewable resources (fraction of 1900 reserves remaining)
B	Crude birth rate (births per 1000 persons per year)
D	Crude death rate (death per 1000 persons per year)
S	Services per capita (dollar equivalent per person per year)

Each of these variables is plotted on a different vertical scale. We have deliberately omitted the vertical scales and we have made the horizontal time scale somewhat vague because we want to emphasize the general behavior modes of these computer outputs, not the numerical values which are only approximate. The scales are, however, exactly equal in all the computer runs presented here, so results of different runs may be easily compared.

All levels in the model (population, capital, pollution, etc.) begin with 1900 values. From 1900 to 1970 the variables plotted in figure 3 (and numerous other variables included in the model but not plotted here) agree generally with their historical values to the extent that we know them. Population rises from 1.6 billion in 1900 to 3.5 billion in 1970. Although the birth rate declines gradually, the death rate falls more quickly, especially after 1940, and the rate of population growth increases. Industrial output, food, and services per capita increase exponentially. The resource base in 1970 is still about 95 percent of its 1900 value, but it declines dramatically thereafter, as population and industrial output continue to grow.

The behavior mode of the system shown in figure 3 is clearly that of overshoot and collapse. In this run the collapse occurs because of non-renewable resource depletion. The industrial capital stock grows to a level that requires an enormous input of resources. In the very process

Figure 3 WORLD MODEL: Present Trends Continue



The "standard" world model run assumes no major change in the physical, economic, or social relationships that have historically governed the development of the world system. All variables plotted here follow historical values from 1900 to 1970. Food, industrial output, and population grow exponentially until the rapidly diminishing resource base forces a slowdown in industrial growth. Because of natural delays in the system, both population and pollution continue to increase for some time after the peak of industrialization. Population growth is finally halted by a rise in the death rate due to decreased food and medical services.

of that growth it depletes a large fraction of the resource reserves available. As resource prices rise and mines are depleted, more and more capital must be used for obtaining resources, leaving less to be invested for future growth. Finally investment cannot keep up with depreciation, and the industrial base collapses, taking with it the service and agricultural systems, which have become dependent on industrial inputs (such as fertilizers, pesticides, hospital laboratories, computers, and especially energy for mechanization). For a short time the situation is especially serious because population, with the delays inherent in the age structure and the process of social adjustment, keeps rising. Population finally decreases when the death rate is driven upward by lack of food and health services.

The exact timing of these events is not meaningful, given the great aggregation and many uncertainties in the model. It is significant, however, that growth is stopped well before the year 2100. We have ignored discontinuous events such as wars or epidemics, which might act to bring an end to growth even sooner than our model would indicate. In other words, the model is biased to allow growth to continue longer than it probably can continue in the real world. We can thus say with some confidence that, under the assumption of no major change in the present system, population and industrial growth will certainly stop within the next century, at the latest.

The system shown in figure 3 collapses because of a resource crisis. What if our estimate of the global stock of resources is wrong? In figure 3 we assumed that in 1970 there was a 250-year supply of all resources, at 1970 usage rates. But let us be more optimistic and assume that new discoveries or advances in technology can double the amount of resources economically available. A computer run under that assumption is shown in figure 4. The overall behavior mode — growth and collapse — is very similar to that in the standard run shown in figure 3. In this case the primary force that stops growth is a sudden increase in the level of pollution, caused by an overloading of the natural absorptive capacity of the environment. The death rate rises abruptly from pollution and from lack of food. At the same time resources are severely depleted, in spite of the doubled amount available, simply because a few more years of exponential growth in industry are sufficient to consume those extra resources.

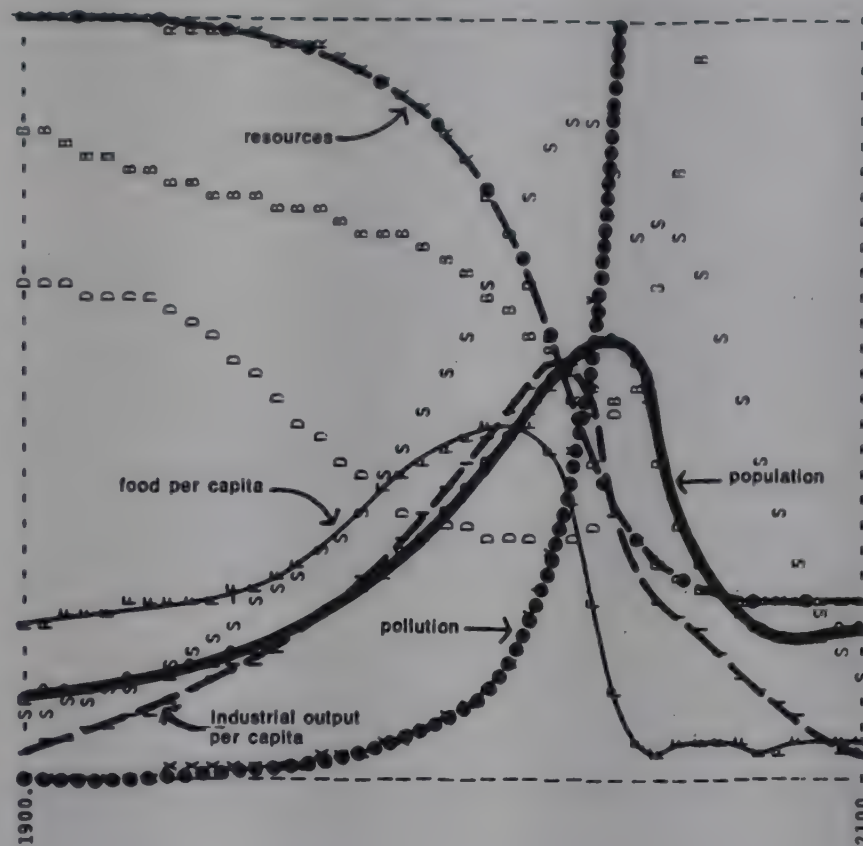
Technology

There is no single variable called "technology" in the world model. We have not found it possible to aggregate and generalize the dynamic implications of technological development because different technologies arise from and influence quite different sectors of the model. Birth control pills, high-yield grains, television, and off-shore oil-drilling rigs are all technological developments, but each plays a distinct role in altering the behavior of the world system. Therefore we must represent each proposed technology separately in the model, considering carefully how it might affect each of the assumptions we have made about the model elements.

The technology of controlled nuclear fission has already lifted the impending limit of fossil fuel resources. It is also possible that the advent of fast breeder reactors and perhaps even fusion nuclear reactors will considerably extend the lifetime of fissionable fuels, such as uranium. Does this mean that man can master vast, inexhaustible energy sources that will release unlimited raw materials for his industrial plants? Some experts believe that abundant nuclear energy resources will enable mankind to discover and utilize otherwise

Figure 4

WORLD MODEL WITH NATURAL RESOURCE RESERVES DOUBLED



To test the model assumption about available resources, we doubled the resource reserves in 1900, keeping all other assumptions identical to those in the standard run. Now industrialization can reach a higher level since resources are not so quickly depleted. The larger industrial plant releases pollution at such a rate, however, that the environment pollution absorption mechanisms become saturated. Pollution rises very rapidly, causing an immediate increase in the death rate and a decline in food production. At the end of the run resources are severely depleted in spite of the doubled amount initially available.

inaccessible materials (in the sea bed, for example); to process poorer ores, even down to common rock; and to recycle solid waste and reclaim the metals it contains. Although this is a common belief, it is by no means a universal one.

Let us assume, however, that the technological optimists are correct and that nuclear energy will solve the resource problems of the world. To express the possibility of utilizing lower grade ore or mining the seabed, we have doubled the total amount of resources available. We have also assumed that, starting in 1975, programs of reclamation and recycling will reduce the input of virgin resources

needed per unit of industrial output to only one fourth of the amount used today. Both of these assumptions are, admittedly, more optimistic than realistic. The results of these assumptions [diagram not shown here] are that resource shortages indeed do not occur. But growth is stopped by rising pollution, as it was in figure 4. The absence of any constraint from resources allows industrial output, food, and services to rise slightly higher than in figure 4 before they fall. Population reaches about the same peak level as it did in figure 4, but it falls more suddenly and to a lower final value.

We assumed in the last computer run that the advent of nuclear power neither increased nor decreased the average amount of pollution generated per unit of industrial output. It is likely, however, that a world society with readily available nuclear power would be able to control industrial pollution generation by technological means. Pollution control devices are already being developed and installed on a large scale in industrialized areas. How would the model behavior be changed if a policy of strict pollution control were instituted in, say, 1975?

The world model output is plotted [diagram not shown] assuming both the reduction in resource depletion and a reduction in pollution generation from all sources by a factor of four, starting in 1975. Reduction to less than one fourth of the present rate of pollution generation is probably unrealistic because of cost, and because of the difficulty of eliminating some kinds of pollution, such as thermal pollution and radioisotopes from nuclear power generation, fertilizer runoff, and asbestos particles from brake linings. We assume that such a sharp reduction in pollution generation could occur globally and quickly for purposes of experimentation with the model, not because we believe it is politically feasible. The results indicate that the pollution control policy is indeed successful in averting the pollution crisis of the previous run. Both population and industrial output per person rise well beyond their previous values, and yet resource depletion and pollution never become problems. The overshoot mode is still operative, however, and the collapse comes about this time from food shortage.

As long as industrial output is rising, the yield from each hectare of land continues to rise (up to a maximum of seven times the average yield in 1900) and new land is developed. At the same time, however, some arable land is taken for urban-industrial use, and some land is eroded, especially by highly capitalized agricultural practices. Eventually the limit of arable land is reached. After that point, as population continues to rise, food per capita decreases. As the food shortage becomes apparent, industrial output is diverted into agricultural capital to increase land yields. Less capital is available for investment, and finally the industrial output per capita begins to fall. When food per capita sinks to the subsistence level, the death rate begins to increase, bringing an end to population growth.

This problem could be viewed either as too little food or as too many people. The technological response to the first situation would be to produce more food, perhaps by some further extension of the principles of the Green Revolution. The technological solution to the second problem would be to provide better methods of birth control. The results of putting into the computer these two changes, instituted in 1975, along with the changes in resource use and pollution generation we have already discussed, are as follows.

First we assume that the normal yield per hectare of all the world's land can be further increased by a factor of two. The result is an enormous increase in food, industrial output, and services per capita. Average industrial output per person for all the world's people becomes nearly equal to the 1970 U.S. level, but only briefly. Although a strict pollution control policy is still in effect, so that pollution per unit of output is reduced by a factor of four, industry grows so quickly that soon it is producing four times as much output. Thus the level of pollution rises in spite of the pollution control policy, and a pollution crisis stops further growth.

We then try the alternate technological policy — perfect birth control, practiced voluntarily, starting in 1975. The result is not to stop population growth entirely because such a policy prevents only the births of unwanted children. The birth rate does decrease markedly, however, and the population grows more slowly. In this run growth is stopped by a food crisis occurring about 20 years later than in the next to last computer run.

Finally, we apply increased land yield and perfect birth control simultaneously. Here we are utilizing a technological policy in every sector of the world model to circumvent in some way the various limits to growth. The model system is producing nuclear power, recycling resources, and mining the most remote reserves; withholding as many pollutants as possible; pushing yields from the land to new heights; and producing only children who are actively wanted by their parents. The result is still an end to growth before the year 2100. In this case growth is stopped by three simultaneous crises. Overuse of land leads to erosion, and food production drops. Resources are severely depleted by a prosperous world population. Pollution rises, drops, and then rises again dramatically, causing a further decrease in food production and a sudden rise in the death rate. The application of technological solutions alone has prolonged the period of population and industrial growth, but it has not removed the ultimate limits to that growth.

Although we have many reservations about the approximations and simplifications in the present world model, it has led us to one

conclusion that appears to be justified under all the assumptions we have tested so far. The basic behavior mode of the world system is exponential growth of population and capital, followed by collapse. As we have shown in the model runs described here, this behavior mode occurs if we assume no change in the present system and also if we assume any number of technological changes in the system.

The unspoken assumption behind all of the model runs we have presented is that population and capital growth should be allowed to continue until they reach some "natural" limit. This assumption also appears to be a basic part of the human value system currently operational in the real world. Whenever we incorporate this value into the model, the result is that the growing system rises above its ultimate limit and then collapses. When we introduce technological developments that successfully lift some restraint to growth or avoid some collapse, the system simply grows to another limit, temporarily surpasses it, and falls back. Given the assumption that population and capital growth should be left to "seek their own levels," we have not been able to find a set of policies that avoids the collapse mode of behavior.

A choice of limits. Applying technology to the natural pressures that the environment exerts against any growth process has been so successful in the past that a whole culture has evolved around the principle of fighting against limits rather than learning to live with them. This culture has been reinforced by the apparent immensity of the earth and its resources and by the relative smallness of man and his activities. But the relationship between the earth's limits and man's activities is changing. The exponential growth curves are adding millions of people and billions of tons of pollutants to the ecosystem each year. Even the ocean, which once appeared virtually inexhaustible, is losing species after species of its commercially useful animals. Recent FAO statistics indicate that the total catch of the world's fisheries decreased in 1969 for the first time since 1950, in spite of more mechanized and intensive fishing practices. (Among commercial species becoming increasingly scarce are Scandinavian herring, menhaden, and Atlantic cod.)

Yet man does not seem to learn by running into the earth's obvious limits. The story of the whaling industry demonstrates, for one small system, the ultimate result of the attempt to grow forever in a limited environment. Whalers have systematically reached one limit after another and have attempted to overcome each one by increases in power and technology. As a result, they have wiped out one species after another. The outcome of this particular grow-forever policy can only be the final extinction of both whales and whalers. The alternative policy is the imposition of a man-determined

limit on the number of whales taken each year, set so that the whale population is maintained at a steady-state level. The self-imposed limit on whaling would be an unpleasant pressure that would prevent the growth of the industry. But perhaps it would be preferable to the gradual disappearance of both whales and whaling industry.

The basic choice that faces the whaling industry is the same one that faces any society trying to overcome a natural limit with a new technology. Is it better to try to live within that limit by accepting a self-imposed restriction on growth? Or is it preferable to go on growing until some other natural limit arises, in the hope that at that time another technological leap will allow growth to continue still longer? For the last several hundred years human society has followed the second course so consistently and successfully that the first choice has been all but forgotten.

The State of Global Equilibrium

We have seen that positive feedback loops operating without any constraints generate exponential growth. In the world system two positive feedback loops are dominant now, producing exponential growth of population and of industrial capital. In any finite system there must be constraints that stop exponential growth. These constraints are negative feedback loops. The negative loops become stronger and stronger as growth approaches the ultimate limit, or carrying capacity, of the system's environment. Finally the negative loops balance or dominate the positive ones, and growth comes to an end. In the world system the negative feedback loops involve such processes as pollution of the environment, depletion of non-renewable resources, and famine.

The delays inherent in the action of these negative loops tend to allow population and capital to overshoot their ultimately sustainable levels. The period of overshoot is wasteful of resources. It generally decreases the carrying capacity of the environment as well, intensifying the eventual decline in population and capital. The growth-stopping pressures from negative feedback loops are already being felt in many parts of human society. The major societal responses to these pressures have been directed at the negative feedback loops themselves. Technological solutions, such as those discussed above, have been devised to weaken the loops or to disguise the pressures they generate so that growth can continue. Such means may have some short-term effect in relieving pressures caused by growth, but in the long run they do nothing to prevent the overshoot and subsequent collapse of the system.

Another response to the problems created by growth would be to weaken the positive feedback loops that are generating the growth.

Such a solution has almost never been acknowledged as legitimate by any modern society, and it has certainly never been effectively carried out. What kinds of policies would such a solution involve? What sort of world would result? There is almost no historical precedent for such an approach, and thus there is no alternative but to discuss it in terms of models — either mental models or formal, written models. How will the world model behave if we include in it some policy to control growth deliberately?

Now that we are seeking a "better" result, we must define our goal for the system as clearly as possible. We are searching for a model output that represents a world system that is:

1. sustainable without sudden and uncontrollable collapse; and
2. capable of satisfying the basic material requirements of all of its people.

Deliberate constraints on growth. You will recall that the positive feedback loop generating population growth involves the birth rate and all the socio-economic factors that influence the birth rate. It is counteracted by the negative loop of the death rate. The overwhelming growth in world population caused by the positive birth-rate loop is a recent phenomenon, a result of mankind's very successful reduction of worldwide mortality. The controlling negative feedback loop has been weakened, allowing the positive loop to operate virtually without constraint. There are only two ways to restore the resulting imbalance. Either the birth rate must be brought down to equal the new, lower death rate, or the death rate must rise again. All of the "natural" constraints to population growth operate in the second way — they raise the death rate. Any society wishing to avoid that result must take deliberate action to control the positive feedback loop — to reduce the birth rate.

For the moment let us suspend the requirement of political feasibility and use the model to test implications of limiting population growth. We need only add to the model one more causal loop, connecting the birth rate and the death rate. In other words, we require that the number of babies born each year be equal to the expected number of deaths in the population that year. As the death rate decreases, because of better food and medical care, the birth rate will decrease simultaneously. Such a requirement, which is as mathematically simple as it is socially complicated, is for our purposes an experimental device, not necessarily a political recommendation.

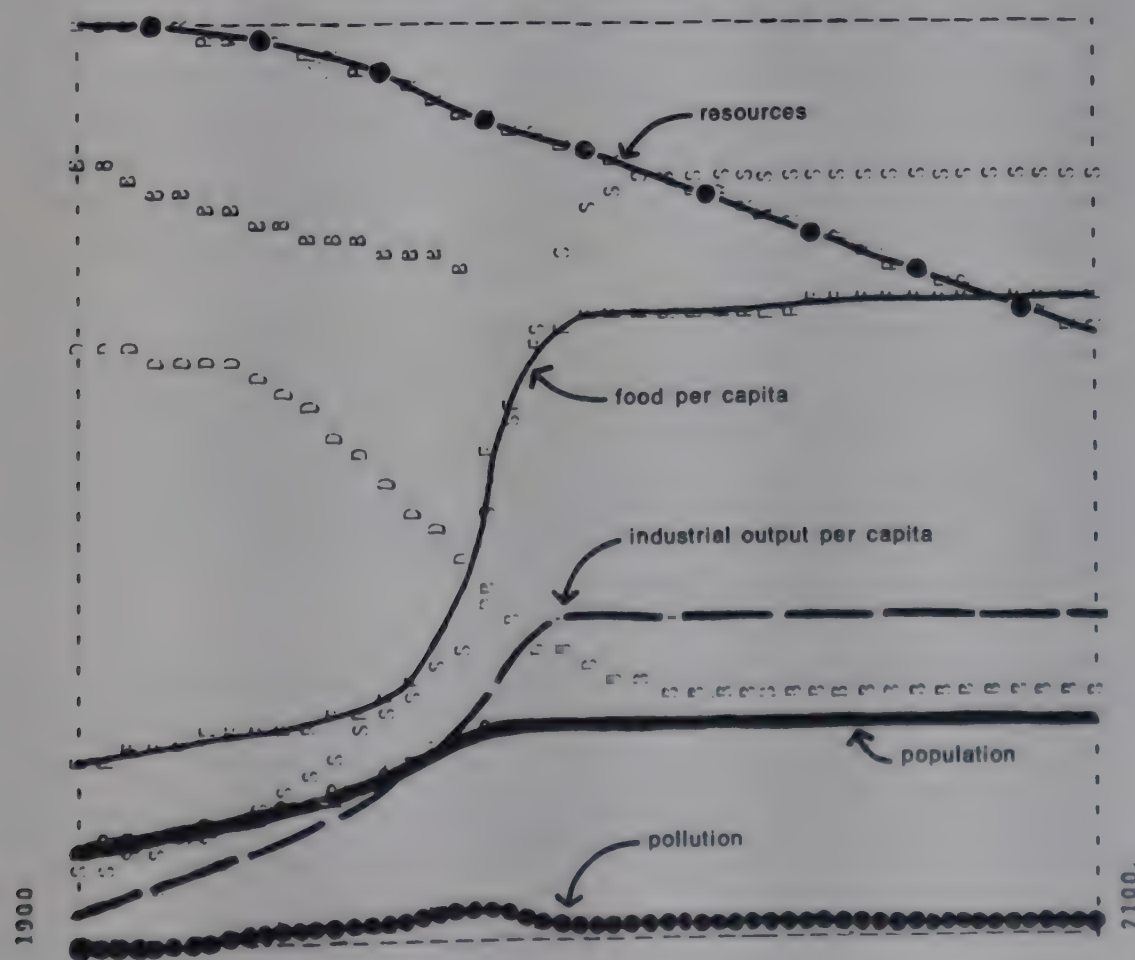
The result of inserting this policy into the "standard" model in 1975 was tested. At first the birth and death rates are low. But there is still one unchecked positive feedback loop operating in the

model — the one governing the growth of industrial capital. The gain around that loop increases when population is stabilized, resulting in a very rapid growth of income, food, and services per capita. That growth is soon stopped, however, by depletion of non-renewable resources. The death rate then rises, but total population does not decline because of our requirement that birth rate equal death rate (clearly unrealistic here).

Apparently, if we want a stable system, it is not desirable to let even one of the two critical positive feedback loops generate uncontrolled growth. Stabilizing population alone is not sufficient to prevent overshoot and collapse. A similar computer run with constant capital and rising population shows that stabilizing capital alone is also not sufficient. What happens if we bring both positive feedback loops under control simultaneously? We can stabilize the capital stock in the model by requiring that the investment rate equal the depreciation rate, with an additional model link exactly analogous to the population-stabilizing one.

What model assumptions will give us a combination of a decent living standard with stability? We can improve the model behavior greatly by combining technological changes with value changes that reduce the growth tendencies of the system. Different combinations of such policies give us a series of computer outputs that represent a system with reasonably high values of industrial output per capita and with long-term stability. One example of such an output is shown in figure 5.

Figure 5 STABILIZED WORLD MODEL 1



The policies that produced the behavior in figure 5 are:

1. Population is stabilized by setting the birth rate equal to the death rate in 1975. Industrial capital is allowed to increase naturally until 1990, after which it, too, is stabilized, by setting the investment rate equal to the depreciation rate.
2. To avoid a nonrenewable resource shortage, resource consumption per unit of industrial output is reduced to one-fourth of its 1970 value.
3. To further reduce resource depletion and pollution, the economic preferences of society are shifted more toward services such as education and health facilities and less toward factory-produced material goods.
4. Pollution generation per unit of industrial and agricultural output is reduced to one-fourth of its 1970 value.
5. Since the above policies alone would result in a rather low value of food per capita, some people would still be malnourished if the traditional inequalities of distribution persist. To avoid this situation, high value is placed on producing sufficient food for all people. Capital is therefore diverted to food production even if such an investment would be considered "uneconomic."
6. This emphasis on highly capitalized agriculture, while necessary to produce enough food, would lead to rapid soil erosion and depletion of soil fertility, destroying long-term stability in the agricultural sector. Therefore the use of agricultural capital has been altered to make soil enrichment and preservation a high priority. This policy implies, for example, use of capital to compost urban organic wastes and return them to the land, a practice that also reduces pollution.
7. The drains on industrial capital for higher services and food production and for resource recycling and pollution control under the above six conditions would lead to a low final level of industrial capital stock. To counteract this effect, the average lifetime of industrial capital is increased, implying better design for durability and repair and less discarding because of obsolescence. This policy also tends to reduce resource depletion and pollution.

The stable world population of figure 5 is only slightly larger than the population today. There is more than twice as much food per person as the average value in 1970, and world average lifetime is nearly 70 years. The average industrial output per capita is well above today's level, and services per capita have tripled. Total average

income per capita (industrial output, food, and services combined) is about \$1,800. This value is about half the present average U. S. income, equal to the present average European income, and three times the present average world income. Resources are still being gradually depleted, as they must be under any realistic assumption, but the rate of depletion is so slow that there is time for technology and industry to adjust to changes in resource availability.

The numerical constants that characterize this model run are not the only ones that would produce a stable system. Other people or societies might resolve the various trade-offs differently, putting more or less emphasis on services or food or pollution or material income. This example is presented as an illustration of the levels of population and capital that are physically maintainable on the earth, under the most optimistic assumptions. The model cannot tell us how to attain these levels. It can only indicate a set of mutually consistent goals that are attainable. But the model indicates one more very important relationship: the longer we delay the introduction of the stabilizing policies, the lower will be the level of material living standards that can be sustained.

[Extracted from The Limits to Growth by Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W. Berhrens III. A Potomac Associates Book (New York: Universe Books, 1972). No portion of this article may be reprinted without the expressed permission of Potomac Associates (1707 L Street, N. W., Washington, D. C.). In the case of translations into languages other than English, permission must be obtained from The Club of Rome (Via Giorgione 163, 00147 - Rome, Italy.]

Report on the Limits To Growth

World Bank Task Force
Mahbubul Haq, Chairman

[The World Bank report summarized here criticizes The Limits to Growth (see preceeding article) on a number of points. The expected damage from pollution appears to have little scientific basis; the supplies of non-renewable resources are likely to last much longer than anticipated and with no very certain limits. Population growth cannot continue forever at present rates, but the world growth rate may soon start to decline.]

The study on The Limits to Growth (abbreviated here to Limits), sponsored by the Club of Rome and conducted by an MIT team of systems analysts headed by Professor Dennis L. Meadows, appeared with great fanfare in March 1972. The study immediately commanded world-wide attention and raised a storm of controversy all around. The World Bank task force conceived of its job as an objective and balanced analysis of the basic thesis set out in the Limits and a study of its implications for development policy. It has been by no means easy to keep to this course, as the Limits has aroused strong emotions and its authors have been variously hailed as "visionaries" and "prophets" and condemned as "villains" and "fools". It has been our effort to stay away from such rhetoric and to undertake as objective a study of the Limits as we could manage. If we have strayed away from this path at times, it may be because of the highly charged climate of opinion within which this report had to be compiled.

Other members of the task force were Messrs. N.G. Carter, E.K. Hawkins, D. H. Keare, B. Varon, C. Weiss, and K. C. Zachariah.

Basic Thesis of the Limits Model

The basic thesis of the Limits is a simple one — and for that very reason it has a powerful appeal. It derives its force from the basic notion that infinite growth is impossible in a finite plant. It lends an air of frightening urgency to this proposition by contending that the limits to growth are already being reached and that mankind is destined for catastrophe during the next hundred years unless growth is stopped right away. When the basic thesis of the model is broken down into its major components, the following themes emerge:

(1) Many critical variables in our global society have been growing at an exponential rate — in particular, population and industrial production. The absolute increment each year is becoming extremely large by now.

(2) Unless deliberate action is taken, such exponential growth will continue in the future, with each year's absolute increase becoming more and more unmanageable.

(3) The world's physical resources, however, are finite — particularly cultivable land, nonrenewable minerals and the capacity of the earth and its atmosphere to "absorb" pollution.

(4) Technological progress can expand some of these physical resources for some time to come but not all of them and certainly not indefinitely.

(5) Sooner or later, the exponential growth in population and industrial production will bump into these physical limits and catastrophic results will follow, including a sudden and uncontrollable decline in both population and industrial capacity.

(6) It is better, therefore, to establish conscious limits on our future growth rather than let nature establish them for us in a catastrophic fashion. More specifically, the salvation of the world lies in moving towards zero growth rates in population and in industrial production by 1975.

(7) The authors concede that more optimistic alternative assumptions can be built into their model, but they contend that this merely postpones the problem by a few decades and does not really alter its essential nature.

(8) The authors also warn that changes in some elements in the system have their effects on others only after a long time so that it is better to err on the side of action now rather than later.

(9) The authors are conscious of some of the problems that adoption of zero growth rates may raise for the world. They hint at policies of income redistribution between the rich and the poor nations as well as within these nations, and they plead for a change in the composition of production away from industrial output and towards more social services. However, the part on policy implications is the least developed in the book.

Analysis of the Basic Assumptions

We started our enquiry by examining critically the assumptions which had gone into the Limits model. It is a truism, after all, that a model is only as good as the assumptions which are built into it. Our investigations showed that many assumptions in the model were not scientifically established, and the use of data was often careless and casual. This was particularly true of the assumptions regarding nonrenewable resources and pollution. We also found that the model was fairly sensitive to the choice of these assumptions, contrary to the protestations of the authors, and that reasonable adjustments in the assumptions regarding population, nonrenewable resources and pollution could postpone the prediction of catastrophe by another 100 to 200 years even if one accepted the general methodology of the model.

Population. The Limits model is right in postulating that world population has been growing exponentially in the last century and that, if the present rate of growth continues, the present population of 3.6 billion will double in the next 35 years. While the population assumptions for the medium run are fairly sound, the model does not do full justice to a number of factors which are likely to come into play in the long run, and may even be significant in the short run. To begin with, some of the recent demographic trends indicate that fertility has already started declining in a number of countries. Of the 66 countries for which accurate data are available, as many as 56 show a decline. Most demographers are agreed by now that the 1970s will see the world population growth rate reach a plateau so that by 1980 population growth rates will tend to decline, slowly at first and rapidly thereafter.

One of the major features in the population model of the Limits is that fertility and mortality levels are determined largely by economic factors, mainly the level of industrial production and the output of services. Population growth in the Limits model can be reduced by increasing per capita industrial production which, in turn, increases the output of services, including education. The latter then both permits the growth of family planning services and creates the climate for their use to be effective. The model does not deal well with the possibility that the population growth rate might decline even at low per capita income levels through birth control programs, as has occurred in a few countries.

No one will deny, however, that continued population growth at the present rate is a serious matter which should engage the urgent attention of humanity. As Dr. Fred Singer puts it quite graphically: "To see that limits exist to any kind of continued growth, one need only consider that if the present world population were to be doubled 15 more times, there would be one man for each square yard on all of the land areas including Antarctica, Greenland and the Sahara Desert; and at the present rate of growth, this would require only a little more than 500 years." The real question, therefore, is not whether population growth can continue unchecked forever: it simply cannot. The real issue is how to arrest it through conscious population planning policies, and through technological breakthroughs in population control methods suitable for use in the poor nations. This is the issue that policymakers have begun to wrestle with. But even if the population control efforts are successful, the world will still be left with a substantial population problem in both absolute numbers and scope for future growth. The long lags involved in demographic change ensure that population growth would continue for several generations after balance had been achieved between mortality and fertility. Any prognostication about the future, therefore, must take into account the inevitability of a world population several times larger than the present 3.6 billion.

Nonrenewable Resources. A number of assumptions have been made about nonrenewable resources which turn out to be extremely pessimistic on close examination. The figures on reserves of nonrenewable resources generally come from the U.S. Bureau of Mines. There is no better source of world statistics; but the USBM's work is biased by its task of ascertaining U.S. needs and supplies of materials. U.S. reserves and those of countries supplying U.S. demands are more rigorously forecast than reserves in countries not relevant to that purpose. The authors of Limits have ignored the small print of the USBM statement which warns that 80% of their reserve estimates have a confidence level of less than 65%. Some of the reserve estimates are extremely old or incomplete, particularly for the Communist countries. Some of the estimates go as far back as 1913 in the case of China. Furthermore, these reserve estimates have changed frequently over time, and are likely to change again in our lifetime. Just between 1954 and 1966, in the case of one of the largest resources, iron ore, the reserve estimates have gone up by about 5 times. It is estimated by the USBM that even these reserves can be doubled at a price 30% to 40% higher than the current price. Similarly, the reserve estimates for copper today are 3.5 times higher than in 1935 and it is estimated that a trebling of the price could raise them to a level 8 times that of 1935. Reserve estimates for bauxite increased sevenfold between 1950 and 1972. Many of these reserve estimates are conservative contingency forecasts by the exploration companies and they are related to a certain price: if the price is higher, more

resources can be exploited commercially. The authors allow for this in their model by the "generous" assumption that reserves could increase by 5 times over the next 100 years; but what they call an act of generosity turns out to be an unduly conservative assumption in the light of historical evidence and recent finds.

The pessimism of the assumptions on nonrenewable resources becomes even more evident if we review some more information that has accumulated recently. For instance, the potential for exploiting seabed resources appears to be great and imminent. The most promising underwater source of minerals are the nodular materials distributed over millions of square miles of ocean floor. Much research needs to be done on seabed resources — research which, no doubt, will be stimulated as there is greater exhaustion of nonrenewable resources on land. But the important point is that these possibilities are already becoming real and imminent and are no longer in the realm of science fiction.

Let us add to this the fact that the concept of resources itself is a dynamic one: many things become resources over time. Needs and the ways of meeting them change; but Limits has simply extrapolated the USBM's 30-year projections of requirements indefinitely into the future. Each century has seen new resources emerge. The expansion of the last hundred years could not have been sustained without the new resources of petroleum, aluminum and energy. What about the possibilities of the day after tomorrow — solar energy, seabed resources, and what else? Again, let us also add the possibility of a sharp reduction in the use of natural resources per unit of output through further technological progress. Even with our present knowledge it is impossible to say with any conviction that nonrenewable resources are going to be depleted in the next hundred years.

It is not our intention to dispute that resources, after all, are finite, nor to deny that some are more scarce than others. But we should realize that the true magnitude of resource availabilities is uncertain rather than proceed on the conviction that they are definably finite. Uncertainty calls for taking out reasonable insurance. The Limits' prescription is a radical one, amounting to nothing less than telling the patient to live without exposing himself to the very risks of life. If certain resources are likely to become more scarce, it is a scientific and intellectual service to humanity to draw attention to those resources and to the time period over which they may vanish with current usage and on present knowledge. Research into these areas is both useful and vital to prepare for the time when supply inelasticities will increase sufficiently to induce new adaptations. But it is quite another thing to argue that no amount of research or technological breakthroughs will extend the lifetime of these resources indefinitely. To forecast supply inelasticities in advance of their occurrence is a definite service

whereas sweeping generalization about a complete disappearance of all nonrenewable resources at a particular point of time is mere intellectual fantasy.

Much has been heard recently of an energy crisis in the developed countries. This is not, of course, an ultimate crisis for the availability of sufficient energy sources to meet demand, but is more a crisis of policy on what sources of energy those countries should be reliant on, at which prices, and from where these sources should be obtained. There is still a vast potential of energy which could be tapped with changed economic circumstances or technological advance. They include discovery of new reserves, improved recovery of proven energy reserves, exploitation of the Athabasca tar sands and Arctic oil and gas in Canada, the Orinoco tar belt in Venezuela, nuclear energy, solar energy, and perhaps the use of hydrogen as fuel extracted from water by nuclear energy.

We would also do well to remember that the waste of natural resources is a function of both public attitude and seeming abundance. It is quite possible — and indeed probable — that with either of the above factors changing, resources can be conserved without undue pain. For the major flaw of today's pattern of consumption is not really that we consume too many final goods and services, but that we use our resources strikingly inefficiently towards that end. If certain resources become more scarce and their relative price increases, there will be a powerful incentive for their more efficient use — something that the Limits ignores. For instance, energy can be much more economically used. There is scope for smaller cars with weaker engines, public rather than private transport, increasing efficiency in burning fuels and in generating and distributing electricity, and improved design of aircraft engines and bodies.

Looking at the problem, as the Limits to Growth has done, in terms of quantifying the life expectancy of resources as presently constituted, we conclude that these are sufficient to last very much longer than the authors have stipulated. It is not a question of expecting natural resources to accommodate forever our current patterns of growth, production and consumption; clearly, they will not. But we are confident that natural resources will last long enough to allow us time to make deliberate adjustments in our manner of using natural resources in such a way that resource needs can be met indefinitely. We have seen no convincing evidence to suggest that mankind faces a final curtain about 100 years from now through depletion of non-renewable resources.

Pollution. The assumptions regarding pollution are the weakest part of the model. In many cases they are not established on any scientific basis. We still know so little about pollution generation

and absorption, and about the effects of pollution, that definite functions are very hard to establish. The consultants who were asked by the Bank to look at the pollution aspect of the Limits model did so indirectly by examining the corresponding part of the Forrester model in World Dynamics, on which the Limits model was based, because the actual Limits model was not yet available. They found that if the ratio of pollution generation to capital stock in the Forrester model were to be reduced to three-eighths the value originally assumed — an adjustment well within the error range of the data — the prediction of catastrophe would be erased. Similarly, the Forrester model assumes that there is a limit to the amount of pollution the world can absorb in a year and that this limit is four times the pollution now produced annually. There is absolutely no scientific evidence to support such a conclusion.

Both models assume that pollution levels beyond certain limits will affect birth rates and death rates; but, once again, there is no real evidence to support this contention. Progressive pollution levels may destroy present concepts of living during the next hundred years, but the model builders marshal little scientific evidence to prove it will destroy life itself.

This is not to suggest that pollution is not an important issue in many industrialized countries. It is — and becoming more so. But the assumptions regarding pollution in the model are ill-considered and not based on any scientific data. Moreover, the authors do not fully allow for the fact that higher levels of industrial development also increase the options of these societies to take care of the pollution problem by devoting additional resources to it. In fact, some recent estimates show that about 80-90% of the present pollution can be removed at a relatively low cost: the cost increases would be of the order of about 5% for industrial waste; 2% for thermal electricity; and 10% for automobiles. Similarly, Alan Kneese estimates that if the U.S. wanted to achieve a substantial reduction in pollution over the next six years, it could do so by devoting \$16 billion a year, or about one-third of the increase in its GNP over this period, to fighting pollution; despite this, the U.S. could still increase its per capita consumption by about \$900. This is a choice that the societies can make — and are obviously in the process of making at present — without giving up continued economic growth.

Nature of the Model

From an analysis of the basic assumptions of the model, we turned to its essential nature and methodology. Here we found that our analysis was considerably handicapped by the very high level of aggregation in the model. The whole world is treated as one and homogeneous, even though the authors note that the world is characterized by vast differences

in income and consumption patterns. The highly aggregate nature of the model raises a number of difficulties in analysis. For one thing, it is not clear how seriously one can take averages of various variables which are widely dissimilar. Such averages can give extremely misleading results. For another, it makes any plausible interpretation of the model very difficult. There is only one aggregate natural resource, and one aggregate pollutant, keeping one guessing as to how representative their behavior is of the real world which is marked by much greater diversity, complexity and substitutability.

More important, it is not possible to get any useful policy guidance from such an aggregate view of the world. The real world is divided politically into a number of nation states and economically into developed and developing countries. They do not all behave similarly nor are they affected in the same manner. Thus, if natural resources are getting progressively depleted, this may raise their price and benefit the producing countries which are mostly in the developing world. The transfer of resources from the rich to the poor nations in such a situation may well alter the overall pattern of growth rates. Thus, there are some natural checks and balances in the real world which are not allowed for in the aggregate world model of the Limits which goes only in one direction — towards ultimate disaster. Before we can arrive at any useful or relevant conclusions, a minimum condition is to construct at least a "two-world" model, distinguishing between the developed and the developing world. In fact, a greater degree of disaggregation is called for; otherwise, there is a great danger that aggregates may become a caricature of the real world rather than a mere abstraction.

The methodology used in the model moves us along the road to disaster. There are no costs and prices in the model and no conscious choices made by society — in fact, no real corrective mechanism. There are only physical engineering relationships — not much of economic and social engineering. The world of the model proceeds in its merry ways — frittering away its resources, populating itself endlessly, accumulating pollution — till one fine morning it hits disaster. There are no automatic or deliberate corrective mechanisms which come to its rescue. There is only one aggregate pollutant which becomes too much for human life at some stage.

In the real world, there is not one nonrenewable resource but many. They do not suddenly disappear collectively but become more and more scarce individually. As each resource becomes more scarce, price signals flash and alarm bells ring all over the world. This directs technological research into them; possibilities of substitution are explored; conscious choices are made by society to economize on them, to do without them, or to enlarge their exploitation by using marginal reserves or by recycling at a higher price. In other words,

corrective mechanisms start working. Similarly, it is hard to believe that a pollution crisis can sneak up on humanity so insidiously as the model implies. Even a modest level of pollution would mean that, even though the world average of persistent pollutants were still quite low and not yet obnoxious to human health, some particular localities would be suffering grievously from pollution. Can we really believe that most of the population of Detroit could succumb to persistent pollutants without the rest of humanity making any adjustments in its producer-consumer behavior? Humanity faces these problems one by one, every year in every era, and keeps making its quiet adjustments. It does not keep accumulating them indefinitely till they make catastrophe inevitable. One does not have to believe in the "invisible hand" to subscribe to such a view of society. One has merely to believe in the possibility of human sanity and the instinct for self-preservation.

Since the authors of the Limits model are interested in long-term projections, they should also use a longer-term historical perspective. It would be interesting if they were to step back about one hundred years in history — say, 1872 — and to feed the data, state of knowledge, technology etc. of that time into their computer and to see what kind of predictions follow. And if the computer shows that we all met disaster a few years ago — or, at least, we should have — we should then examine the corrective mechanisms which came into play to save us from such a disaster. Was it because population growth in the developed world did not behave in the manner predicted at that time? Was it because society made a few conscious choices? Such a study could be quite educative. It would show how corrective mechanisms which are lacking in the Limits model work out in real life. And it would oblige the authors to show us why these corrective mechanisms are supposed not to work in the future.

One of the most troublesome parts of the model is its treatment of the role of technology. In an age of the most dramatic technological progress, the authors contend that there cannot be a continuation of such rapid progress in the future. The model assumes that certain things in this world will grow at exponential rates — population, capital stock, pollution. It assumes that certain other things will not grow at exponential rates — specifically technology, both to enlarge the resource base and to fight pollution. Thus, a catastrophe is built into the model by assumption without regard for history. Now, how realistic is this? As known nonrenewable resources are progressively depleted, can we not find technological improvisations to economize on the use of these resources or to recycle them completely or to find new resources in ocean and space? As societies become conscious of pollution problems, will they not find the technology to fight it, as is already becoming apparent?

The basic utility of the Limits model is to bring out inter-relationships between various critical variables like population, pollution and

nonrenewable resources, and to highlight certain areas in which further research work needs to be done. The model is also useful in bringing home the long time lags between various policy actions and their eventual impact so that the need for a good deal of advance research work and planning is stressed. But the model should not be taken too literally. It is fairly lacking in its conception and in its methodology. More work needs to be done to find out whether long term models covering 100 to 200 years can be usefully constructed and, if so, what degree of disaggregation should be built into these models so that they serve as a guide to operational policy. Some serious research work has already begun in a number of institutions all over the world. In the last analysis, activating some of this work may well turn out to be the most valuable contribution of the Limits model. While the model itself contains hardly any mention of conscious corrective mechanisms, in a larger sense its very appearance can well be regarded as part of the corrective mechanism that societies devise in response to major problems.

Policy Implications of the Model

Unfortunately, the policy implications which flow from the Limits model are the least stressed and the least developed part of the book. And yet, these policy implications have attracted the greater attention since the book has appeared. The major policy conclusion of the model is the prescription of a zero growth rate, both in population and in material production. But that prescription is not logically derived from the model. Even if one accepts some of the premises of the authors about certain physical limits to further unchecked growth, it is not quite clear from their work as to why the world must immediately move in 1975 to zero growth rates. Since the model is too aggregated, the authors are in no position to discuss various alternative choices which are still open to society even if physical limits to growth are conceded.

There is, for example, the choice between development and defense. Presently, about \$200 billion are being spent on defense which is one of the major users of world resources and generators of pollution. If the society is really concerned about resource constraint, could it not consciously make a choice to devote fewer resources to defense and more to development? Again, there is the choice of patterns of growth. If natural resources become more scarce, could the society not decide to have a different pattern of consumption, based on more services and leisure, which normally consume less material resources? Could not the growth of the developing world be designed to proceed without putting major pressures on the global physical limits even if they were to exist? These are some of the real choices that humanity faces at present, and a good deal of debate is centering around them. But the consideration of these choices gets pushed aside in the context of the Limits model and its sweeping overall policy prescriptions.

Another area of policy concern is world income distribution. If we were to accept the thesis that the world cannot be "saved" except through zero growth rates, as the authors do, we must also demonstrate that world income redistribution on a massive scale is possible. Otherwise, freezing the present world income distribution would not "save" the world either, because of the inevitable confrontation between the haves and the have-nots. The Limits recognizes this but does not address itself to the basic issue: how is such a redistribution to be brought about in a stagnant world? Income redistribution is a desirable objective and must be pursued with full vigor; but it will be an extraordinarily difficult endeavor, and it would be even more difficult to achieve, both within nations and among nations, if there were no prospect of future growth and various groups were forced to fight one another to keep their share in a stagnant world.

The policy implications of the Limits model about population growth seem to be more valid than those about future growth in production. Even when one rejects the notion of a zero growth rate in industrial and agricultural production and in capital stock, one can appreciate the advantages of stabilizing world populations. This would release much energy and effort from catering to ever increasing numbers and divert it to improving the well-being of the existing population levels. It is increasingly true that the absolute increment in world population every year is becoming uncomfortably large, and we are fast becoming an overcrowded planet. It is also true that slower population growth would reduce the urgency of finding technological solutions to resource shortages and pollution crises: there is no reason why humanity should be under constant pressure to seek or accept technological fixes in desperation, without considering the full environmental implications of new technology. But the Limits model performs no real service by linking the population growth rate so intimately with per capita industrial production levels as to imply that populations cannot be stabilized in poor nations through conscious and aggressive population control policies.

In the last analysis, we may well find that social and political limits on future growth turn out to be far more important than mere physical limits. It may be possible to overcome some of the physical limits through continued technological progress, as has happened during the last century, but it might become increasingly difficult to cope with the complex political and social problems that an overcrowded planet creates. We are already witnessing a growing feeling in many societies that individuals are becoming impersonal pieces of the total society and can no longer relate to it meaningfully, either in the social field or through the political forums. The question we may well have to debate is whether the world is growing too large to govern itself while maintaining any decent political order or social cohesion.

There are many areas of potential disaster that humanity faces, irrespective of the sterile dialogue on whether physical limits to human

survival exist or not. These disasters may arise because of the inadequacy of national or international institutions to deal with the problems of a large planet and the inability of these institutions, public and private, to recognize and react to potential crises. Issues of nuclear war and income disparity between rich and poor nations fall within this category and have rightly engaged a good deal of the attention of mankind. While the sweeping conclusions of the Limits to Growth and the publicity which has accompanied the appearance of the book have created enough shock waves to start some serious work on issues of global survival, the main danger is that the debate may get dragged into the wrong channels — that is, in fighting some of the false issues that the Limits has raised, rather than into more constructive fields. We cannot refrain from quoting the very apt conclusion that Carl Kaysen reaches on this score in the July 1972 issue of Foreign Affairs:

Finally, therefore, how much does "crying wolf" help to direct social energies toward improving our responses to these problems? In principle, it is not only useful, but indispensable. The social mechanism is made up of human beings moved by passion far more than by reason. The mobilization of feeling that is the necessary prelude to all but the most routine social action requires some stimulus stronger than a sound argument. But to be effective, the cry must be well directed: the wolves must be imminent and they must indeed be wolves. On this score we can give only a moderate grade to "Limits", or more properly, to its sponsors in The Club of Rome. The problems they call us to attend are real and pressing. But none are of the degree of immediacy that can rightly command the urgency they feel. Indeed, at least two problems of world-wide consequence outside the scope of this work seem to be more urgent than any it deals with: the creation of an international order stable enough to remove the threat of nuclear war, and the diminution of the staggering inequalities in the international distribution of wealth. A good sentry does not cry up tomorrow's wolves and ignore today's tigers.

[Extracted from Report on the Limits to Growth, World Bank, Washington, D. C., September 1972, pp. 1-21 with some materials from Annexes to the Report.]

Ecologists Versus Economists

Hazel Henderson

[All the talk of the "energy crisis," zero population growth, the need for a new "steady-state economy," the ecological limits to growth, and the inadequacy of the gross national product (GNP) as a measure of progress signals a growing debate between ecologists and economists. This article reviews a group of books to provide an overview of the debate. The author emphasizes the ecological critique of economic analysis.]

It was the environmentalists who began to question the premise that an economy could continue helter-skelter growth without eventually incurring severe environmental losses, but not without some precedents among economists. John Kenneth Galbraith's The Affluent Society in 1958, questioned why the U.S. economy seemed so well-supplied with hair oil, tail-finned cars, and plastic novelties in the private sector while cities decayed and air and water became polluted. Elaborating on this theme, economist Kenneth E. Boulding attributed much of man's despoiling of nature to his inadequate frame of perception. In Beyond Economics, written in 1968, he claimed that man still saw his natural resource base as a limitlessly exploitable frontier. This "cowboy economics," as Boulding termed it, did not account for environmental costs -- i. e., "externalities" which are part of the true cost of production. Boulding predicted that, with the growth of air and space travel, we would finally come to realize that we live on a vast spaceship which is a closed, rather than an open, system. [For a brief statement of Boulding's thesis see Development Digest, January 1971, p. 12.]

I should note that the English economist, Alfred Marshall, introduced the concept of externalities as far back as 1890.

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He showed economists that they should be concerned with forces outside conventional market activities. But the externalities of which Marshall wrote were mostly positive and included the rising levels of education of workers and the public services provided by government, from which the entrepreneur of that time had profited but to which he had made no contribution. His younger contemporary at Cambridge University, A. C. Pigou, became interested in the notion that there could also be negative externalities, as he watched smoke and sparks pour out of an English factory chimney. But this concept remained a theoretical abstraction until K. William Kapp published his Social Costs of Private Enterprise in 1950. Kapp documented the environmental and social effects of business activities. His basic thesis was that the maximization of net income by micro-economic units (entrepreneurs, corporations, and so on) was likely to reduce the income or utility of other economic units and of the society at large. In short, he claimed that conventional measures of the performance of an economy were misleading, since they ignored social and environmental costs.

The Ecological Broadside

In 1971, systems analyst Jay W. Forrester's World Dynamics appeared (reviewed in Development Digest, April 1972, p. 29). This book attempted to develop a computer model, on a world scale, for the interactions over time of population growth, food supply, capital investment, geographical space, pollution, and resource depletion. By a different route, Forrester came to the same conclusion as had Kapp in 1950: in complex, nonlinear systems the optimization of any subsystem will generally conflict with the well-being of the larger system of which it is a part.

Most economists scoffed at World Dynamics and also at the later study, The Limits to Growth (see p. 3), prepared by Forrester's colleagues at the Massachusetts Institute of Technology. They argued against the very large aggregations of data and other methodological approaches used by Forrester and his colleagues. But it soon became necessary for economists to address population, resource, and distribution issues, because Forrester's work had created such an impact that these issues had entered the realm of political debate and action.

Gradually, economists with intellectual investments in economic "growthmanship," such as Henry C. Wallich and Walter Heller, began to deal with the problems raised by Forrester and others. Their first evaluations were that these were new Malthusian scares. Since Thomas Malthus's grim predictions of overpopulation and food shortage were made 150 years ago and had not yet occurred, except in localized regions, economists argued that they would be unlikely to occur in the future. Resource shortages were discounted because, as in the past, prices would rise and encourage innovation.

The environmental view, however, was that, while technological innovation is vital, it would be foolhardy to place faith in technology as the infinite source of salvation. It might be just as likely for a technological plateau to occur, as has happened in so many other civilizations in the past, and for research investments to yield diminishing returns. Moreover, although prices will undoubtedly rise to reflect specific scarcities and encourage substitution in the prescribed manner, environmentalists pointed out that prices are merely subjective expectations of availability and are not based on objective scientific research. There are often severe time lags between the scientists' warnings of increased resource depletion or major ecosystem disturbances (e.g., accelerating water eutrophication rates) and the point at which security analysts, bankers, corporate financial officers, and economists digest this new knowledge and crank it into their forecasts. Even Henry C. Wallich, who had at first derided World Dynamics and The Limits to Growth, later wrote in Fortune magazine (October 1972) that such lags might not provide enough lead time to change pricing policies accordingly.

In addition, correct pricing must reflect information on environmental externalities. Although such information can be obtained or approximated in many cases, few social institutions support its collection or back campaigns for its dissemination. An obvious example of such pricing lags is U.S. electricity-rate policy, which still reflects earlier assumptions of continued abundance. Thus major users of electricity receive subsidies while the nation is in a power crisis.

The Debate Shifts

The controversy over the environment not only continues to expand but also has led to what is becoming the nub of the ecology versus economics debate: the distribution of wealth. While environmentalists maintain that economic growth must be curtailed in the name of ecological sanity, most economists hold that economic growth (presumably as currently defined by GNP) is the only way to ensure that increasing shares of wealth trickle down to the poor.

Such a plea for the inflation-prone, trickle-down model of economic growth forms the basic argument of Retreat From Riches: Affluence and Its Enemies. Written by Peter Passell and Leonard Ross, this book is only passingly concerned with the ecological limits to growth, which it dismisses in one chapter with arguments that growth is the only means of increasing the lot of the poor. Like most economists, they see environmental protection largely in terms of correct effluent taxation. While environmentalists agree that effluent taxes are a useful "fine-tuning" tool for reducing pollution, they argue that such taxes do not serve to reduce resource-depletion rates or improve energy-conversion efficiencies, where the real economic and ecological payoffs lie.

Beset by the arguments for growth and by charges from economists and corporate executives that, in their ecological zeal, they wished to

stop economic growth now that they had achieved middle-class comfort, environmentalists were at first baffled over how to deal with this issue. Then Barry Commoner, in his 1971 book, The Closing Circle, zeroed in on the distribution question and provided the environmentalists with both new direction and new ammunition. Commoner's argument was three-pronged:

1. He noted that, if economic growth would have to be stabilized at some future point, then there could be no further moral justification for the "trickle-down" theory of growth and distribution. The earth's resources would give out long before such uneven economic growth could ever provide for the millions still waiting in poverty. Those unlucky enough to be traveling in steerage class on "Spaceship Earth" would never even make it to the second-class deck.

2. He declared that excessive consumption by rich nations not only condemned the third world of less-developed countries (LDCs) to poverty, but also caused most of the environmental devastation. These "overdeveloped" nations were disrupting the environment because of their increasingly capital - (i. e. , resource-) intensive production methods. They used highly profitable but polluting technology to synthesize artificial rubber, fibers, and plastics in place of naturally produced commodities with low profit margins. Moreover, since such commodities (e. g. , wool, cotton, sisal, hemp, leather, and latex rubber) comprised a large proportion of most third world exports, the rich nations were decimating the export markets, and thus the economies, of LDCs.

3. He maintained that the "overdeveloped" nations, whose populations had stabilized in step with their rising standards of living, had achieved this stability through "colonial" exploitation of LDC resources. Continued heavy resource consumption by the overdeveloped countries, he argued, would prevent LDCs from achieving their own "demographic transitions" to stable populations. Hence his conclusion: ecological sanity now requires social justice.

Commoner's analysis, and the growing evidence that conventional arguments for trickle-down distribution are open to question, turned the environmental movement toward a much more radical critique of economic and social arrangements. In addition, the movement had been stung by barbs from industry and confronted with corporate tactics designed to put environmentalists in conflict with labor (e. g. , over a few highly publicized plant closings) and with the poor and consumers (e. g. , by warning of astronomical price rises due to environmental controls).

A key element in the environmentalists' growing concern over the distribution of wealth and income is related to contentions by several authors that many environmental problems result from the increasing

production, consumption, and waste caused by planned obsolescence and the creation of wants by advertising. For example, Herman E. Daly asks in his book, Toward a Steady-State Economy, "Why do people produce junk and cajole other people into buying it? Not out of any innate love for junk or hatred of the environment, but simply in order to earn an income." Daly believes that we need some principle of income distribution that is independent of and supplementary to the income-through-jobs link.

The ethic of distributing the "flow of wealth" through jobs is at the heart of the growthmanship effort. This "flow fetishism" of standard economic theory holds that everyone gets part of the flow — call it wages, interest, rent, or profit — and everything looks rather fair. But, Daly asks, what about the stock of wealth (capital)? If the stock of wealth is held tightly by a few people, then most people must rely for survival on the flows it engenders (i. e., jobs or welfare). And, because of a growing population, the flow cycles must be continuously increased by whatever means possible. The results are built-in obsolescence, waste, creation of new wants through advertising, and government pork-barrel projects. Environmentalists ask, "Why are we dependent on the production of goods in the private sector to maintain employment, goods that are ill matched with such new human needs as mass transit and clean sources of power? Why can we not restructure our corporate and governmental institutions to meet new and future needs instead of continuing to address past conditions?"

Environmentalists find analyses such as that of Daly supportive, because they highlight the propensity of the private-sector economy to continually substitute capital for labor. This, of course, taxes the environment and increases rates of resource depletion through the massive-scale, centralized operations it allows. As Arthur Pearl of the University of Oregon put it in a recent article in Social Policy, "In essence, we now have a surplus of human beings and a shortage of nonrenewable resources: thus we have to reverse our historical view of efficiency." He added, "It is only in a human services society which is labor-intensive rather than capital-intensive that the resources of the earth will be conserved and human resources be expended for the benefit of human beings."

In Beyond Economics, Kenneth E. Boulding elaborates on the politics of economic distribution. He claims that there are three basic modes of human transaction: 1) The primitive threat system (e. g., "Give it to me or I'll kill you") with its more sophisticated "blackmail" variation (e. g., "How much will you pay me to stop harming or annoying you?") 2) The exchange system of market economies. 3) The maturing, integrative system in which increasing interdependence is necessary for the viability of the whole economy. In his forthcoming book, The Economy of Love and Fear: A Preface to Grants Economies, Boulding contends that the U. S. economy is moving (in spite of policy lags and distributional errors) toward such an integrative system, which he terms the "grants economy." As evidence, Boulding points to ubiquitous grants and income transfers and

increasing acceptance of responsibility for the disabled, unemployed, aged, and poor. He also points to the public services and amenities, which provide a viable context for market activities, and to "positive externalities." By the latter, he means commodities that benefit the society as a whole yet represent investments that are not fully recapturable. Knowledge and the flow of information, for example, play an increasing role in advanced production, innovation, technological change, and economic development but receive less than their share of attention from economists.

A recent book, The Economics of Information and Knowledge, edited by Donald M. Lamberton, surveys some of the crucial knowledge and information issues raised by Boulding. The Lamberton book is an important one for environmentalists because it underscores that, without vastly more information among buyers and sellers in this complex age, the uncontrolled aggregation of small decisions could add up to large-scale ecological chaos. The way such chaos evolves is described by ecologist Garrett Hardin in his now-famous treatise, "The Tragedy of the Commons." In feudal England, Hardin points out, all the farmers grazed their flocks in a large communal field (the commons). Some farmers realized, however, that they could maximize their advantage by grazing more animals than their neighbors. It was only a matter of time before the idea caught on and the commons was destroyed by overgrazing. Likewise, if we arbitrarily designate a jointly shared resource — such as air, water, or even whales — as a "free good," then no individual is responsible for its overall protection. As a result, it is likely to be destroyed completely.

Economics and Social Values

The markets of conventional economics cannot provide much information on how to cope with such free-goods problems, in which public resources can be depleted and public services jeopardized by the temptation of each individual to avoid paying his share or restraining his greed. Moreover, argue the environmentalists, economics is ill-suited to dealing with value preferences that cannot be assigned monetary weightings. Such qualitative value conflicts must be left to the political arena, where they face a key axiom of Kenneth J. Arrow's "general impossibility theorem." Arrow states that, in democracies, individual preferences cannot be logically ordered into social choice. In response to Arrow's dismal prognosis for democracy, Edwin T. Haefele has argued that Arrow's conditions for ordering individual preferences into social choice can be met by representative governments with a two-party system.

The debate over social choice theory, however abstract it seems, is vital because it concerns the structuring of orderly societies that seek to optimize the general welfare without individual repression. Herman E. Daly, in Toward a Steady-State Economy, believes that both radical

institutional changes and a paradigm shift in economics are required for a society to achieve a political economy of biophysical equilibrium and "non-material" growth in areas such as knowledge, leisure, and the arts. Daly advocates a steady-state economy, with constant stocks of people and physical wealth maintained at some chosen level by a low rate of throughput (i. e., flow of goods, services, resources, and so on). He suggests these key steps for achieving this goal: first, Daly endorses a plan by Boulding for issuing each individual a license at birth to have as many children as correspond with the dictates of replacement fertility; the licenses could then be bought and sold on the open market. Second, he argues for transferable resource-depletion quotas, based on estimates of reserves and the state of technology; these would be auctioned off annually by government. Third, he advocates a distributive institution that would limit the degree of inequality in wealth and income.

As many of the papers in The Economics of Information and Knowledge suggest, production has now become so complex, based increasingly on such abstract commodities as knowledge, that it is no longer possible to neatly formulate the rewards due to labor and the rewards due to capital. The inadequacy of the traditional distribution formula concerns environmentalists for another crucial reason. It is precisely these knowledge inputs to production which increase energy-conversion efficiencies and reduce resource-depletion rates.

The fuel cell is an example of such a knowledge-intensive, resource-conserving product, the value of which is difficult to distribute via the traditional formula. The fuel cell's energy-conversion potential is some 60% (compared to 12% for the internal combustion engine), and it is largely this advance which represents its greater value. To whom does the fuel cell belong and who shall share in its rewards? The operators? The person who invented the fuel cell? Or the taxpayers whose government grant supported the university which supported the research? Such interwoven inputs no longer provide a neat distribution formula; in fact, such complex forms of production are essentially social.

This and other problems make it increasingly difficult to design accurate economic models so as to avoid the dangers of forcing public decisions into the straightjacket of cost/benefit analysis. Paul Streeten illustrates this point by noting that cost/benefit analysis has the tendency to convert political, social, and moral choices into pseudotechnical ones; hence its psychological appeal to administrators, but also its logical flaw. "If two objectives conflict," argues Streeten, "say the requirements of industrial growth and protection of the environment, someone will have to choose. The choice may be democratic, dictatorial, or oligarchical, but choice it must be." Streeten holds that cost/benefit analysis, using the economist's often highly arbitrary weightings, conceals such value conflicts, which can only be resolved politically.

In addition, some economists are busy trying to examine the costs and benefits of pollution control. Using marginal analysis, they are attempting

to evaluate environmental goals in terms of the willingness to pay for some standard of environmental quality, or the willingness to accept compensation for damage. As K. William Kapp notes, this economic "compensation principle" as a criterion for environmental quality leaves no doubt in anyone's mind that the common denominator is going to be money. Kapp continues, "The basically questionable point of departure consists in the fact that original physical needs for rest, clean air, non-polluted water, and health, as well as the inviolability of the individual, are being reinterpreted in an untenable way as desires or preferences for money income." He also maintains that the compensation principle does not take income distribution or information requirements into account, and does not lead to systematic research into alternative policy options.

If money is an inadequate measure for harmonizing economic activities with the ecosystem, what new criteria might be devised to evaluate the policy decisions which will face citizens in some future steady-state economy? As a few daring economists begin to respond to this question with new concepts, we will see their discipline incorporate more data on resource factors. Kenneth E. Boulding and Barbara Ward, for example, first drew their fellow economists' attention to the unrewarded chemical work of natural ecosystems powered by the sun, which should provide baseline data for economic models. In 1971, Howard T. Odum's book, Environment, Power and Society, noted the inadequacy of economic models in capturing the value of such energy cycles and chemical exchange work (for example, in changing carbon dioxide from combustion back into usable oxygen). In a new, unpublished paper, Odum has devised a "value system" that converts kilocalories to dollars and permits a cost/benefit analysis to credit work performed by the natural systems on which all economic activities eventually rely.

Economist Nicholas Georgescu-Roegen's new book, The Entropy Law and the Economic Process, sets the problem of inadequate economic paradigms in a heroic space-time context. He points out that economic activities create qualitative and irreversible changes, all tending toward the dissipation of ordered matter and energy, into an eventual state of undifferentiated molecules with no further potential, i. e. entropy. While matter can be reached with inputs of energy, energy itself can never be recycled. In the last analysis such qualitative processes are not subject to the quantitative modelling that economists use to portray them. One implication of the concern with entropy is that all economic processes must be remodeled in their entirety, from extraction to fabrication to distribution to consumption to waste to recycling. This is necessary to pinpoint hidden energy subsidies along the way, and to compare the energy-conversion efficiency of each part of the production cycle. Thermodynamicist Stephen Berry has prepared such a model of the life cycle of the automobile, which leads him to conclude that the largest energy and "thermodynamic-potential" savings can be achieved in the basic method of metal

extraction and fabrication, which could, in principle, reduce the "Thermodynamic costs" of automobiles by factors of five, ten, or more. By comparison, extending the life of the vehicle could realize savings of 50% to 100%, while recycling could achieve a saving of roughly 10%.

All of these new issues lead environmentalists to call for a reexamination of cultural notions of "value." The economic impact of these qualitative concepts surrounding the concern for "quality of life" is discussed by Walter A. Weisskopf in his new book, Alienation and Economics. Weisskopf stresses that notions of value are arbitrary and culture-bound. For example, he holds that the U.S. economy overvalues material wealth while dismissing psychic wealth. Similarly, we overvalue competitive activities and undervalue cooperation and social cohesion. The real dimensions of scarcity are not economic, claims Weisskopf, but existential. Time, life, and energy are for people the resources that are ultimately "scarce" because of their mortality. These needs can never be satisfied by purely economic means, although economic activity that satisfies lower-order survival needs permits them to emerge. In short, humans tend to assign values arbitrarily and then pay measurers to collect only those data which conform to prevailing assumptions of "value." Environmentalists have intuitively come to the same conclusions.

Conclusion. Many of the environmentalists' indictments of economists may seem esoteric. Yet some of them are spurring more openminded economists into new efforts to create fresh concepts and paradigms, such as those discussed in this article. After all, economics is the discipline concerned with scarcity, choice, and the behavior of equilibrium systems, all of which are still central concerns for the future. Although many of the young radical economists in the United States have criticized their colleagues' overwhelming preoccupation with market economics and the elegant contours of the closed, equilibrium systems it hypothesizes, they are no happier with the bureaucracy that typifies so many centrally controlled socialist and communist economies. And five-year plans can be just as environmentally destructive as those of entrepreneurs or government agencies in market economies. A review of the many new micro-economic studies now being undertaken by a few economic innovators is needed to supplement some of the broader concepts discussed here.

[Extracted from "Ecologists Versus Economists," Harvard Business Review. Cambridge, Massachusetts: Graduate School of Business Administration, Harvard University, July-August 1973, pp. 28-36, 152-57. Copyright © by the President and Fellows of Harvard College.]



**AGRICULTURE
MARKETING**

MEDIUM SIZED FOOD STORE IN BRAZIL
(PHOTO: UNITED PRESS INTERNATIONAL).

Marketing as a Tool of Development

Frank Meissner

[Agricultural marketing is not making as great a contribution to development as it should; seven reasons are given.]

In modern societies marketing coordinates and guides the production, assembly, processing, storage and distribution of goods and services. This makes marketing an integral part of the social system; behavior of market participants is conditioned by customs and traditions. These, in turn, affect exchange relationships, attitudes toward institutional change, and willingness to adopt new procedures.

Market processes increase in importance as a community develops, and as more of the people move to urban areas. Also, with the introduction of modern technology into agriculture, farmers purchase industrially produced inputs such as fertilizer, pesticides, and machinery. At the same time, the consumer's food costs come to include a growing share of marketing services. As a result, marketing activities begin to constitute a larger proportion of total economic activity while the farmer's share of the consumer dollar declines. Because food production and distribution make up a large proportion of economic activity in less-developed countries, increased productivity and reduced real costs of food can have a significant impact on living standards and economic growth rates. Productivity increases in processing and distribution stages have just as important an impact on total food costs as do productivity increases on the farm.

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In most developing countries, marketing progress is being slowed down by at least seven adverse conditions, which prevail in different degrees of intensity:

1. There are few relevant data about the existing marketing systems.
2. Many public servants and economists are strongly biased against middlemen.
3. The pervading attitude of distrust and antagonism toward private intermediaries is reflected in policies arbitrarily establishing direct government intervention in distribution activities, rules against speculation, and various forms of price control. The tendency is to maintain farmer prices and reduce consumer prices with little concern for the middleman, including the retail reseller. There has been a notable lack of technical assistance and special credit programs to improve productivity and incomes among food system intermediaries. Such a lack seems to imply a belief that production is largely the physical creation of products on farms or in factories and that marketing services add little to the final product value.
4. Political leaders tend to support construction of visible physical marketing projects such as rural assembly centers, central urban wholesale markets, all sorts of warehouses and storage facilities, agroindustries, truck terminals, and market access roads.
5. With the exception of ideological support to cooperatives, little aid is available for development of viable business enterprises and marketing institutions. This makes it difficult for small and medium-sized entrepreneurs to organize themselves in a manner that would permit use of mass marketing technologies.
6. Both at regional and national levels there is lack of awareness about the close interrelations that exist between rural and urban marketing activities. There is also little understanding of the ways the food system changes in the socioeconomic development process. Therefore, rural and urban marketing is being considered separately rather than as aspects of an integrated system.
7. There are few professionals with specialized skills in analysis of marketing coordination systems.

On the asset side of the ledger is the incontrovertible fact that the rapid growth of cities has brought to a high level of political priority a concern about food costs, employment, and social services. A strong incentive thus exists to improve marketing and thereby reduce costs to consumers, especially in low-income areas.

[Extracted from "Marketing As A Tool of Development, " Preface to International Conference on Marketing Systems in Developing Countries, Tel Aviv, January 1974. Proceedings to be published in 1975 by John Wiley and Sons, New York, and Israeli Universities Press, Jerusalem.

Government Services for Agricultural Marketing

Hans Mittendorf

[The effectiveness of government marketing-facilitating services, such as training, market information, the research and advisory services, is vitally important to accelerate development of marketing channels and enterprises. These services are particularly important in developing countries since the predominant small-scale enterprises are unable to organize the services themselves. The government has therefore to provide the necessary assistance.]

The effectiveness of marketing-facilitating services depends largely on the extent to which they are oriented to the particular situation of marketing and the stage of a country's development. The more accurately the goals to be achieved can be identified, the more specifically the content and orientation of marketing support services can be defined. While a clear classification of marketing situations prevailing in developing countries is extremely difficult, the following three broad categories may be helpful in analyzing the specific marketing requirements.

1. Countries with a predominantly subsistence type of agriculture and a largely rural population.
2. Countries with transitional, production-oriented agriculture.
3. Countries with market-oriented agriculture and a mainly urban population.

Category 1 may be regarded as including all the 25 least developed countries, i. e. countries of tropical

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Africa, the Indian-populated areas of the Andean region of South and Central America, Haiti, Nepal, Afghanistan and Yemen. These countries have in general an annual gross national product of less than \$150 per capita and two-thirds to four-fifths of the population is still engaged in agriculture, while the urban centers are comparatively small and low-income. Basic grains, root crops and pulses are the main diet, with the consumption of livestock products, fish, fruit and vegetables limited. There are still a number of marketing channels where farmers sell directly to consumers. Quantities offered by farmers are relatively small and vary in quality, quantity and time; there is little grading, and most of the products have to be inspected personally before purchase. Wholesale is hardly developed or is combined with retailing. In terms of infrastructure development, the priorities for marketing improvement are road construction, the building of small storage facilities, small assembly markets in the producing areas, and retail markets in cities. Development of processing facilities should be oriented toward basic processing such as rice, maize and millet mills, slaughter facilities and oil presses, while a secondary type of processing for convenience food (e. g. canning) is limited.

In economies dominated by subsistence agriculture the government has to play an active role in marketing development, especially since small-scale cultivators are not oriented to market requirements and cannot provide a firm basis for organization of an efficient marketing system. Government marketing services will have to assist in planning and building the infrastructure. Standard weights and measures have to be introduced and promoted on a wide scale. The application of minimum standards mainly for cereals and livestock has to be promoted, and a limited market information service oriented to basic food should be established.

The introduction and promotion of agricultural production requisites, in particular fertilizers, is another important area for government support. It is not only essential to familiarize small-scale farmers with the application of fertilizers but also to assist the marketing enterprises to build up a well-coordinated marketing system which ensures that fertilizers of the right quality are available at the right time, at the right place and at the lowest possible cost. The marketing enterprises should not only offer fertilizers for sale but should also provide fertilizer promotion services and credit to small-scale farmers. Incentives to farmers to produce more for the market should also be an important element of the marketing system and government policy. This requires the establishment of a grain price stabilization scheme through the operation of a bufferstock.

The second group of countries includes those where up to half the population already lives in towns and where the local market demand for food is considerably higher, especially for livestock products and fruit and vegetables. As examples, we may mention Colombia, the coastal area of Ecuador, Iran and Korea, countries with an average gross national

product of about \$200 to \$400 per capita. The marketing system is already more highly developed: marketing channels are longer, quantities offered by farmers and handled by traders are larger than in countries of category 1., a division of work between wholesale and retail trade has been elaborated, and the requirements of agriculture for credit and inputs are much more developed. Marketing development programs for these countries should include an extension of the network of transport and storage facilities, an extension and often relocation of wholesale markets, and an extension of the processing industry. The market information service has to be strengthened to cover perishable food, the grain price stabilization schemes have to be extended and price policies to be refined. Market research and advisory services have to become more diversified and specialized, not only with regard to commodities but also with respect to their marketing organization and methods.

The third group of developing countries and areas is characterized by a strongly market-oriented agriculture and by the urbanization of more than 60 percent of the total population. Examples are the southern part of Brazil, the coastal part of Peru and Chile, Costa Rica, parts of Mexico, Lebanon and Cyprus. These are mostly countries with an annual gross national product of more than \$400 per capita. Here the problems of marketing organization and methods are more important and complex because of the increasing demand for marketing services, e. g. processing and packaging, and for perishable food such as meat, dairy products, fruit and vegetables which require a high level of marketing efficiency. Secondary processing industries, canning and cooling facilities, have to be introduced. The requirements for marketing management at the enterprise level are more demanding, and companies are larger in scale and more diversified. Market research has not only to cover organization and methods, but must give more attention to consumer demand and preferences at all levels. The modernization of food retailing and wholesaling through the introduction of self-service, vertical and horizontal coordination and the integration of marketing channels is receiving increasing attention in these countries. The higher capital intensity of the marketing enterprises calls for a more differentiated and refined government policy with regard to marketing and credit, and price policy.

The above classification does not take into account differences within the countries which may be due to the dualistic character of many economies, such as the coexistence of large-scale commercial farms and small-scale subsistence or semi-subsistence farmers as suppliers. The marked difference between the high and low income groups of consumers within the urban areas, particularly in Latin America, is a further factor determining the food retailing system. The type of commodity, perishable or non-perishable, also has an important influence on the organization of the marketing system. Another way of grouping marketing systems may be by the degree of vertical and horizontal coordination affecting marketing of particular products:

1. The traditional subsistence agriculture loosely connected with a marketing system of a low degree of vertical coordination. Market supplies of the subsistence and semi-subsistence agriculture are modest and fluctuate in quality and variety. Most of the products have to be personally inspected by the trade and a considerable time is involved in sorting and cleaning. There is hardly any forward programming within the production and marketing system, and very little consciousness of cost and time. The trucker performs important assembly functions and often sells directly to retailers, while many producers still sell their products directly on local or city markets. The wholesale trade is hardly developed. Standard weights and measures are mostly lacking.

2. Partly vertically coordinated production/marketing system. This refers mainly to the production and marketing of non-perishable foods such as groundnuts, palm kernel, or cotton produced for the export market, with minimum quality standards, standard weights and reasonably well coordinated production/marketing systems. Cost and time consciousness, however, is only moderately developed.

3. Highly coordinated marketing/production system. One example is the banana and fresh vegetable export marketing/production system (Central America, Kenya) where production is programmed ahead in detail by the exporter or importer according to expected market demand. Production/marketing operations are fully coordinated and planned ahead with full attention to timing, cost and prices. There is complete awareness of all farm inputs needed to produce a high quality product at a specific time and at a sustained high level until it reaches the consumer. Product differentiation, branding, and sales promotion are other important features of the system. The system is programmed back from a well defined commercially assessed consumer market through wholesale/retail distribution companies, storage, transport, assembly and finally to the producer. It is the typical situation of contract growing of a highly perishable product where timing and conditions such as refrigeration have to be kept under meticulous control. Research in varieties, marketing methods and techniques (for instance, refrigeration, packing and transport) is planned and initiated by the marketing enterprise which has become the main coordinator and initiator for development. It decides upon the allocation of resources and ensures that these are spent at each stage of the production/marketing system according to the market demand, and that underutilization of resources is kept at a minimum.

Government marketing-facilitating services. In analyzing government marketing support programs, it can be concluded that good progress has been made during the last decade in the improvement of roads, transport (in particular truck transport), communications and storage and processing facilities. Furthermore, the interest in direct government intervention in the marketing process has grown considerably during the last two decades and has resulted in the creation of marketing board-type agencies in nearly all developing countries. Relatively less progress has, however,

been made in the establishment and strengthening of the so-called facilitating services, such as training, applied research, advisory, extension and marketing information services. [On the obstacles to progress, see Spinks article in Development Digest, October 1970, p. 80]

Training. The biggest obstacle to marketing improvement is the lack of understanding of marketing problems and their solutions. This refers not only to government policy makers but also to marketing, entrepreneurs, farmers and consumers. This shortcoming can only be remedied by strengthening marketing training programs at various levels of skill and orienting these programs to local problems. Marketing courses at university level have been started in many developing countries in recent years. However, courses on agricultural and food marketing should be offered to all professions involved in agricultural development, such as agriculturists, lawyers, veterinarians, food technologists and business managers.

The content of marketing courses has to be oriented to the local level of development. In those countries which are at the initial stage of development more emphasis has to be given to rational planning of the infrastructure, introduction of minimum standards, organization of grain price stabilization schemes and elementary knowledge of business management. Category 2 countries have to lay more emphasis on business management methods, feasibility studies for the establishment of processed consumer goods, and operations research. Training in marketing should also include basic principles of product technology such as processing and storage techniques in order to enable the local expert to advise on practical improvement programs. Other topics to be included should be marketing of farm inputs, such as seeds, fertilizers and tools, since the efficient distribution of these products is critical for agricultural production. Export marketing methods and promotion deserve special consideration in view of the high priority given to increased export earnings of developing countries. The teaching effectiveness could be greatly enhanced if more case studies were made available from developing countries.

Although there is some progress in training at the university level, very little progress has been made in training at lower levels. Since most marketing activities are carried out by small and medium-scale entrepreneurs in developing countries, much more emphasis has to be given to their development. The middle level group covers a large number of people with a wide range of responsibilities and skills, which complicates training in marketing from the organizational point of view. There is the large group of rural dealers, retailers, wholesalers, processors, managers of cooperatives and government inspectors and market managers. If a program is intended for these people, their training needs have to be clearly identified, and specialized short courses organized, if possible in connection with an on-going project. Thus, in Kenya there are short weekend courses for bush traders on

fertilizer marketing and credit, and training of buying agents of marketing boards in grading, storage, purchasing and transport of products. CORA-BASTOS, a partly government-supported marketing improvement program in Bogota, Colombia, has organized successful courses for food retailers in connection with a project to establish a private voluntary chain of stores. A similar program is organized by the FAO marketing project in Tanzania, and one for retailers by INPRO in Venezuela. Since most small-scale business people cannot spend much time away from their shops, courses have to be short, specific, oriented to the needs of the trainee, and preferably connected with a practical marketing development project.

Market information. The effectiveness of government marketing policies and the development of efficient marketing enterprises depend to a large extent upon a continual flow of accurate and up-to-date market information. This should, at the initial stage of development, cover at least data on prices, supplies and stocks of staple food and also crop forecasts. This is particularly essential if governments intend to organize a grain price stabilization scheme. In most of the least developed countries, market information services do not yet exist or are too inadequate in coverage and accuracy to be used for decisions on marketing. At a more advanced stage, the market information service should cover perishable food — fresh fruits, vegetables, and meat — and improve its forecasting service.

The organization of market information services requires relatively limited funds for the employment of rapporteurs and a few market analysts. One aspect which is often underrated is the effort needed to make the market information fully understood by the beneficiaries, i. e. farmers and traders, particularly in the countryside. A survey carried out a few years ago in Peru showed that traders and farmers made little use of the weekly radio broadcasting and newspaper information since the message either did not reach the target groups or was not fully understood. Extension work was required to train traders and farmers in making use of the market information in their decisions on production, stocks and market supplies.

Marketing research and extension. Marketing research includes two main areas of work: 1) the assessment of market outlets, and 2) applied research on the introduction of new techniques, methods and forms of organization in the marketing system. The first type of research does not present methodological difficulties but requires improved statistical data; the second field, applied research on marketing improvement, requires considerable strengthening in coverage and depth. It covers the main questions faced by a marketing adviser: What improvements are feasible under specific conditions in the short, medium and long run? What operational methods must be changed to apply improved techniques, and what outside assistance and support are required to implement the recommendations? The rare implementation of the many recommendations made during the last twenty years on marketing improvement in developing countries underlines the need to improve the orientation of applied marketing research and to aim at realistic targets.

Although there is a general awareness of the need to introduce new technology in marketing, the criteria for the right type of technology have to be sharpened. Unfortunately, mere engineering efficiency is often used to decide on investments in new technology without adequate consideration of how the recommended technology fits into the marketing system. More attention should be given to the implications of new technology for employment. This is particularly urgent since people from developing countries are trained in developed countries in labor-saving and capital-intensive methods. The appropriate type of research has been illustrated recently by C. P. Timmer who examined the implications for employment of five different levels of technology in rice milling in Indonesia. He analyzed the following techniques in the light of the criteria of engineering, market, economic and social efficiency: the traditional hand pounding, a huller type of a capacity of 650 tons per year, a Japanese rice mill of 2,500 tons per year, a small and a large bulk unit. The study concludes that, if the social efficiency criterion is applied, the labor-intensive huller technique should make up the bulk of any modernization program for the Indonesian rice milling industry, since this would permit a full use of human resources. It would be useful if the different techniques available could be systematically analyzed in the light of similar criteria for cassava, cashew nuts, grain milling, poultry and livestock processing. Such an analysis would certainly help planners and marketing entrepreneurs to choose the right type of technology.

Other aspects which require more attention are the implications of a new technology for the organization of the marketing system. For instance, the introduction of refrigerated meat transport instead of the transport and marketing of live animals over long distances has various implications. It affects not only the location of the slaughterhouse, such as its relocation from the consuming to the production area, but also the value of by-products; it changes the assembly and distribution methods; it requires investments in a refrigerated wholesale market and affects price formation. Hence the introduction of a new technology at one stage of the marketing channel may have various implications for the organization of the whole marketing system. The fact that the direct and indirect implications of the introduction of refrigerated meat transport in developing countries had not been studied fully has in many instances led to a number of unsuccessful investments in slaughterhouses in livestock producing areas.

[Extracted from "Facilitating Services for Agricultural and Food Marketing in Developing Countries," Paper presented at International Conference on Marketing Systems in Developing Countries, Tel Aviv, January 1974. Proceedings to be published in 1975 by John Wiley and Sons, New York and Israeli Universities Press, Jerusalem.]

Voluntary Chains of Retail Food Stores in Latin America

C. Guthrie

[Methods of food retailing in many Latin American cities are disadvantageous to poor consumers, as illustrated by a survey in Cali, Colombia. Improvements could be attained by voluntary organizations of small shop owners which would provide bulk purchasing and other services for their members, but forming such organizations poses some serious problems.]

In Cali, the 1969 median family spent 66% of its income on food, and similarly high proportions are found in many developing countries. It is no wonder that food prices are a topic of great importance to populations of such countries and to their governments. When one is living close to a subsistence level a rise in food prices is felt acutely; conversely, a reduction in food prices can have a significant impact on improving the standard of life.

Diseconomies of Small-Scale Retailing

Within the last decade several studies have been made of food distribution systems in different cities of Latin America. One of the most relevant attributes of populations in these cities is access to personal transportation. Buyers can be divided into: a) those who can afford private cars or have incomes large enough to pay for transportation without difficulty; and b) those who do not, and must buy most or all of their food at stores located within walking distance of their homes. These "poor" must also buy food frequently, since people who cannot afford cars can seldom afford refrigerators or

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freezers. In Cali the "rich," who find it convenient to buy food anywhere in the community as long as roads and parking facilities are adequate, comprise about 15% of the population. The poor are served by small neighborhood stores, while the rich are served by large stores. Public markets, whose importance lies chiefly in retailing of fresh meat and produce, serve both strata; yet, as cities grow, the number of public markets does not usually increase as fast as population. [Note: For another description of the Cali food distribution system, see Development Digest, October 1970, pp. 71-79.]

Pricing policies. The "trading area" for the majority of consumers, i. e. the distance from which a neighborhood store can attract customers, is rather closely defined as the convenient walking distance. Competitors are the nearest similar stores, usually two to four in number. If the neighborhood store attempts to increase turnover through aggressive pricing policies, competitors will rapidly retaliate. Since foods are price-inelastic, and because lack of mobility means that additional outside customers will not be attracted into the relevant "trading area," the net result of a price decrease will be that sales in money terms will decline. The other option is to raise prices, relying on locational monopoly for protection. This strategy will drive most customers to the stores of nearby competitors. In short, the small storekeeper really has no pricing alternative but to accept the status quo. Because the stores of this type very often are extremely small, the status quo prices involve rather high margins. Although fixed costs are low, they have to be amortized over a small volume of sales.

For the store which sets out to attract customers from the rich, the "trading area" includes the entire city and thus the competition includes all large stores in the city. For meats, produce, and staples, these stores have to meet prices set in the public markets: the extra facilities and more agreeable shopping surroundings give them only a little leeway. Inter-store competition is confined largely to promotional sales of convenience and luxury foods. In Cali there was, in fact, little evidence of active competition of this type; the competitive strategy simply consists of finding a good location near a high-income neighborhood and making the store itself visible, either architecturally or through prominent signs.

The food purchases of the poor are confined almost entirely to basic foods. In contrast, the rich include in their food purchases a high proportion of luxury and convenience items, both "branded" foods and nonfoods. The term "branded" refers to goods that are highly elaborated and packaged, and that are marketed under a strategy that is based on distinctiveness of a company's product rather than price. The prices of these goods are set by manufacturers; margins, available to operators at various levels of

distribution, are generous. In contrast, prices of staple foods — such as rice, beans, and plantains — are set by an impersonal market at wholesale, and at retail level are regulated by the government. Consequently, large stores can trim down their margins on basic foods, making up the difference on branded foods, while neighborhood stores have to make their required gross margins on staples alone.

Relations with wholesaling. There are three principal types of wholesaler — the specialist wholesaler, the sales departments of the food processors (i. e. the distributors of branded foods), and the general wholesalers.

The specialist wholesaler typically handles one or two products, though he may also pick up the occasional truckload of different but related products "if the price is right." These specialist wholesalers work very efficiently as suppliers to stallholders in public markets. Yet, they are poorly adapted to needs of operators of small neighborhood stores because of the very narrow range of lines that each one offers, and because they will not break bulk below case or sack level. To the large stores these are not important disadvantages, but the neighborhood store operator usually has to patronize the general rather than specialist wholesalers.

The general wholesalers in Cali and Caracas were originally large traditional stores which began to be patronized by small retailers. In Caracas, general wholesalers sell almost entirely to retailers. Until 1970 the Cali central public market was also the center of food wholesaling; there, general wholesalers did about half of their trade at retail. None gave trade or volume discounts, so that retailer customers apparently paid about same prices as final consumers. The suppliers to the general wholesalers are specialist wholesalers and the sales departments of food processors or their distributors.

Almost all leading food manufacturing firms are multinationals. Their marketing strategies have been developed by long experience in North America and Europe. The most important characteristics of these strategies are that they permit volume discounts rather than trade or functional discounts, and that they involve large and active sales forces which deal with wholesalers and retailers impartially. They visit all large stores as well as a substantial proportion of neighborhood stores, preferentially selecting the larger members of this group.

Since the products manufactured by this sector are usually luxury items, they constitute only a small proportion of sales of the neighborhood stores, and of their suppliers, the general wholesalers. In Cali total sales of average large stores is approximately equal to those of average general wholesalers. Because branded goods make up a

higher proportion of sales of large stores than of the general wholesaler, large stores can buy branded goods at least as cheaply as the general wholesalers, and certainly much more cheaply than the neighborhood stores. Considering that branded goods are the high-margin items, it is evident why the poor pay higher prices for basic foods than do the rich. It is not that anyone is out to exploit the poor, nor is it part of a sinister plot to keep the poor down. It merely happens that the buying habits of the rich are such that they can be supplied with food more cheaply than the poor can.

How much more do the poor have to pay? Price data from Cali suggest that if the poor bought their food in the large stores they would save about 4% on their food bills. Such direct comparisons are open to question on the grounds of differences in quality and buying habits. Suppose a poor family in Cali suddenly became rich, started buying at supermarkets (large stores), and only changed its eating habits to the extent of consuming prime beef instead of third-quality beef. Taking into account the quality difference between the two grades of beef, food would become almost 9% cheaper, instead of the 4% quoted above.

Government Intervention in Food Distribution

With food prices in South America higher for the poor than for the rich, many governments have attempted to intervene on behalf of the poorer consumer. Typically, governments set maximum prices at which basic foodstuffs may be sold at retail. Naturally, these ceiling prices are set as low as possible "to protect the consumer." Under normal conditions of supply and demand, this provides the small retailer with only a very precarious existence.

When any commodities are in short supply, the small retailer is on the horns of a dilemma, because the wholesale price tends to approach or even to exceed the official retail price. The retailer can react in two ways. He can sell the goods at an "honest" price, which has to be higher than the regulated price; he is then guilty of "speculation" and may be fined accordingly. Or he can refuse to sell the goods, in which case he may be assumed to be guilty of "hoarding," an even more serious offense. What he cannot do is sell the goods at the regulated price, because he just does not have the financial resources to afford this. In contrast, the large stores, with their substantial sales of high-margin luxury items, can afford to sell basic goods at official prices; they will do so simply because they cannot afford the adverse publicity of being reported as having been fined for "speculating." All this further strengthens the contention that the world discriminates against the poor.

On top of all this is added the problem of chronic inflation and pressure to raise farm prices to slow down the rate of rural exodus to cities. Under these circumstances, there will be constant infringements of the price regulations, and perpetual harassment of small retailers who will be cast by the press and public relations media as the gougers and exploiters of the poor. Sooner or later the authorities will yield to the constant pressure to intervene more directly in food distribution. No matter what form it takes, the officials responsible for public food distribution are going to find their tasks frustrating and unrewarding. Dispirited and unhappy organizations rarely perform well. Consequently, the service received by the public will leave a lot to be desired.

There are several reasons for the poor results. First, administering the marketing of beans and rice is not the sort of activity which will appeal strongly to the most ambitious or best qualified civil servants. It is not professional, like the Treasury, the judiciary, or the health services, nor is it glamorous, like economic planning. The new Ministry or Directorate will have little influence at Cabinet level, and will find itself starved of both talent and funds. Second, the public takes its food supplies for granted; the officials will get little thanks for what they do right. But anything they do wrong — and they will inevitably commit their share of mistakes — will be very obvious to the public. There will be, for example, only one Director of Bean Supply: any mistakes he happens to make will result in beans either flooding the market or disappearing completely. There is a tendency to take no decisions unless the responsibility can be shifted on to someone else. Consequently, direct government intervention in urban food distribution should be avoided. Rather, governmental activities should be confined to preventing abuse of consumers and to encouraging structural improvements in marketing systems. Policing the purity of food and the honesty of weights and measures is usefully a matter for the civil authorities, and so is preventing the misuse of market power. If the private sector shows itself unable to do the job properly then, before leaping in itself, the government should first try to remove the barriers to effective performance.

The Role of Private Voluntary Chains

If the private sector wants to avoid direct government intervention in food distribution, it must vigorously try to remedy the main existing defect: the poor paying more for their food, because retailers only handle small sales volumes, buy dear, and have high operating costs per unit of sales.

The problem cannot be solved by locating large stores in poor areas, which do not have sufficient demand to support such stores. Calculations in Cali show that stores of the "superette" type, with

200 to 300 square meters of selling space, can obtain sales volumes from 8 to 18 times greater than those of even the larger existing neighborhood stores. But this sales volume will still not be great enough to permit the superettes to do advantageous buying. Some chain organization will be necessary in order to pool purchases, and to support essential advertising and promotional activities. Integrated corporate chains will not be practicable because of the difficulty of finding enough competent store managers. The alternative to integrated chains is the voluntary chain, i. e. the voluntary joining of retailers in an organization which can make bulk purchases for them and perform other functions.

Latin American precedent. In developing countries, voluntary chains can start with existing physical facilities. Therefore, relatively little capital is needed to get going. Furthermore, managerial skills and talent, which are scarce in developing countries, can be economized. At the middle management level the lack of trained branch managers can be compensated by the experience and direct financial interest of owners of retail outlets. Expertise in accounting and stock control can be readily provided by a small group of specialists at the "head office" of the voluntary chain. In short, the voluntary chain concept appears to be an excellent way of improving the performance of urban food distribution: wholesalers, retailers, and consumers all benefit, while still retaining a substantial degree of independence and flexibility.

So far, however, the considerable success that voluntary chains have enjoyed in developed countries has only sporadically been transferred to Latin America. In Costa Rica some five or six small chains are operating at a rather rudimentary level, and in Bogota, Columbia CORABASTOS is encouraging a scheme called PAN, which has some of the characteristics of a voluntary chain. Since SPAR, a major European voluntary chain, has many members in Spain and Portugal, the concept seems compatible with the Latin temperament. One can only conclude that the lack of Latin American interest in voluntary chains is due to historical accident.

In Europe and North America the centrally organized chain stores made their appearance long before the large supermarket was invented. Their retail outlets were in all respects, except for the fact of chain organization, like the existing independent stores. Yet, their ability to buy advantageously in large volume made it possible for chain stores to consistently undersell independents. Independent retailers, and even more the independent wholesalers, could quite clearly see that the advantages of chains lay in their method of organization. They concluded that some of the advantages of the chain system would have to be reproduced if their operations were to survive. Thus, the voluntary chains — including retailer-owned cooperatives — were born as a survival technique.

In Latin America the situation was completely different: the supermarket was introduced before the chain concept had become adapted. Independent supermarkets, therefore, tended to attribute their success to size, a conclusion which diverted their attention from concentrating on methods of operation. Wholesalers did not perceive the supermarkets as a threat, because rapid urban growth was increasing demand enough to compensate for trade lost to supermarkets, who buy directly from manufacturers and who tend to locate in high income areas. In short, the entrance of supermarkets did not threaten survival of traditional wholesalers and retailers. Consequently, the main motivation to associate into chains for collective action has not yet existed. Furthermore, the possibility of increased profits is not a strong motivation, because the neighborhood retailer is basically a person who makes a bare living by selling food rather than an entrepreneur. Retailers have been reluctant to take the risky step of joining an untried chain that is barely starting up.

These considerations help to explain why so far there has been little interest in voluntary chains in Latin America. But they do not explain why the few chains that have been started so often failed. At least seven factors, singly or in combination, seem to have played important roles.

1. Slow Growth: A voluntary chain of the type needed will find it difficult to survive with less than about fifty member stores. It is likely that in some cases the innovators ran out of financial reserves before the operation could grow to viable size.
2. Overselling the Concept: Voluntary chains offer many advantages in food retailing, but are not a panacea for all ills. If they have been oversold, the retailers who join will become disappointed after a few months. Many will withdraw from the scheme.
3. Credit versus Cash: Prompt payment is of great importance to voluntary buying groups if they are to buy at best terms. Unfortunately, the small retailer appears to attach great importance to being able to work on credit. Failure to overcome this mental barrier may well have caused the collapse of several embryonic chains.
4. Management Failure: Food wholesaling leaves little room for slipshod management. If a wholesaler, trusting too much in the advantages of chain organization, ignores the basics of his business he will soon be bankrupt.
5. Suspicion and Distrust: The chain concept shows how savings can be made available to the constituent wholesalers and retailers. Yet, it says nothing about how the benefits are to be shared among participants. Any retailer who does not feel he is getting a "fair share" of the benefits will soon leave the chain.

6. Lack of Communication: Misunderstandings, especially on occasions when the wholesaler fails to get the best price available, will quickly wreck the morale of the participants.

7. Dishonesty: On some occasions "chains" have been promoted by individuals whose main objective was to run away with the initial subscriptions. Memories of these will be particularly difficult to eradicate. Equally serious in its long-term effect are the wholesalers who try to exploit retailers. Although it does not constitute dishonesty in the strict legal sense, it is a betrayal of the principles of voluntary chains, which emphasize cooperation and coordination rather than strictly arm's-length dealing.

Examination of the failures shows that previous ventures failed to identify those people already active in food distribution who would be likely candidates for membership in voluntary chains; and failed to prepare those people for membership by convincing them of the advantages of chain membership, indoctrinating them in the principles of voluntary associations, and making them aware of the rights and responsibilities of participants in a chain. The preparation stage will be rather prolonged, because it is important that the principles be not merely accepted but fully "internalized," i. e. the message must be received not only by the head but by the heart. For this reason, the second stage should not be rushed.

A good part of this preparation can be carried out in the form of classes, seminars, and group discussions. Two vital steps must take place in the field: identification of likely candidates, and arousing their interest in the idea. Once interested, they can easily be persuaded to obtain an adequate understanding of the voluntary chain concept. When a sufficient number of them have been properly prepared, the starting of the chain itself basically requires only some technical and financial assistance. A chain started in this way should have a very good chance of success. Furthermore, when one or two chains are operating successfully imitators will not take long to come upon the scene.

Field work to establish chains. In 1969 there were approximately 3,500 neighborhood retailers in Cali. From among them a few hundred would have to be selected as likely prospects, whose interest in voluntary chains is to be aroused. This promotional job would require a force of about 20 workers during at least 6 months once the confidence of retailers has been gained, a process which could take a good deal longer. It is expensive and administratively challenging to get together, train, and maintain a field group of this size for an indefinite period.

The aim in forming voluntary chains is to make food available at lower prices to that part of the population which is at present being

served by food distributors who are not as efficient as they could be. Therefore, a public agency should be charged with the responsibility of encouraging formation of voluntary chains and carrying out the necessary activities related to this purpose. The obvious candidate — indeed, by law it may be the only possible candidate -- will be the ministry in whose jurisdiction food distribution lies. But this agency might have been engaged for years in harassing, fining, and promoting schemes designed to eliminate small retailers. Any direct participation by personnel of this ministry in the field work would make the task extremely difficult. Therefore, participation will have to be indirect, and restricted primarily to such activities as financing, research, and coordination. The formal part of the preparatory work can be run under the auspices of suitable bodies, such as the local chambers of commerce or autonomous institutions, such as CORABASTOS in Colombia and the Instituto de Productividad (IN-PRO) in Venezuela.

The group in charge of the field work should have at least the following attributes: a) have working contacts with a substantial proportion of wholesalers and retailers in the community and, particularly, with progressive elements; b) possess enough experience in business matters to be able to recognize prospective candidates for voluntary chains; c) enjoy credibility with wholesalers and retailers; d) be sufficiently cohesive and compact to facilitate being assembled for training sessions; e) have association with successful well-managed organizations in food distribution, so that their recommendation of the voluntary chain concept would be listened to with some respect; and f) avoid direct financial interest in the proposed chains.

As it happens, the above list resembles the qualifications of the sales forces of the major food processors, and it is unlikely that any collection of similar talent could be readily duplicated within any country. Consequently, by far the most effective way of carrying out the field work would be by enlisting cooperation of sales forces of large manufacturers of products which are sold principally through food stores. But these companies are in the business of producing and selling processed food-stuffs. Why should they be concerned about voluntary chains?

The answer to the above question involves the fact that almost all the large food processors are subsidiaries of multinational companies. Since their firms are often subject to hostile scrutiny, they are under pressure to play a constructive role in activities of social importance. Cooperation with these firms would be eased by adhering to certain guidelines.

The direct costs of cooperation to the multinational firms should be small, and it would be possible to make good estimates of such costs. These costs should be reimbursed by the government, either directly or by remitting certain taxes. Therefore, out-of-pocket expense should not be a barrier to obtaining cooperation. A more difficult barrier to cooperation may come from sales managers, who will be reluctant to give up

any of their salesmen's time and who might well be distrustful of attempts to change the nature of their customers. It will take a convincing presentation of arguments in favor of cooperation to overcome this difficulty.

In the short run the existence of voluntary chains can be expected to substantially increase sales of products of the food processors. This is because reducing the prices of basic foodstuffs to people who spend about half their income on these goods creates a very large proportionate increase in discretionary income. A significant proportion of this added income will be spent on branded foods, which will then tend to become accessible luxuries. It is true that the amount spent by each family in this way will be small; but the number of families will be great. In addition to the increased plant efficiency made possible by these increased sales, significant savings will also result from the ability of the processors to deal with only a few central buying offices instead of selling to hundreds of small scattered retailers.

In the longer run, the growth of voluntary chains will dilute the concentrated market power of the principal integrated supermarket chains, which would also help the manufacturers. Due to their position as main suppliers of food to the rich, these supermarket chains now sell a far greater proportion of the total consumption of branded foods than would be suggested by their share of the total food market. In Caracas the food processors already complain that terms of sale are being dictated to them by the two or three principal supermarket chains. Since this concentration of buying power is likely to become greater, food manufacturers should be interested in helping to bring into existence other chains of food retailers before the existing ones become altogether dominant. In the long term it would surely be far better for food processors to deal with, say, 20 large firms, than with 3 or 4 giants. A fundamental question remaining is whether the multinationals will have the vision to assist in the development of voluntary chains in those countries which are ready for them.

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Agribusiness and Latin American Development in the Seventies

Antonio Ortiz Mena

[Agribusiness can contribute a great deal to the improvement of rural incomes and production, as the Inter-American Development Bank (IDB) is increasingly recognizing. Private investment has an important role to play.]

One of the motivations for priority action in the development of agribusiness in Latin America is the inescapable fact that the region's agricultural sector has been consistently lagging in relation to general economic growth. One of the reasons for this is the lack of science-related inputs. In order to attain increased levels of national and individual welfare for the rural population of Latin America, largely bypassed by the 20th century, the contributions of agribusiness and agroindustry will be critical. I should like to state what I mean by these terms.

Agribusiness refers to all activities involved in transport, storage, processing and marketing of farm commodities as well as farm production inputs. Agribusiness systems for coordinating these activities and for guiding farm production can be oriented towards individual geographic areas or regions, commodity groups or sectors of the economy. Agroindustry describes that part of agribusiness which performs primary processing of raw materials of crop, livestock, forest, marine and wildlife origin, and their transformation into finished or semi-finished products. Agricultural marketing is of course that part of agribusiness which directs and facilitates

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flows of commodities and services from producer to final user, funds from consumer to producers, and information between sellers and buyers. In addition, rural industries are processing industries of any sort located in rural areas, including but not limited to agroindustries. Industries have been located in rural areas not only to gain the advantage of a reduction in costs from their proximity to the sources of raw materials, but also for such social objectives as the creation of supplementary income opportunities for peasants and farmers, thus slowing down the population exodus to the major metropolitan areas and fostering the decentralization of economic activity.

Agribusiness and Rural Development

Generally speaking, agribusiness enables a country to take best advantage of its agricultural production, and to overcome such problems as incompletely harvested crops or substantial loss through spoilage in shipments of unprocessed raw materials. It should also be noted that efficient agroindustries have an incentive to promote improved farming methods because they may depend upon raising the productivity of agriculture in order to assure for themselves a larger output, or a different type of output. The need for increased volume of output sometimes arises where there is a competition between supplies for the domestic market, which require only minor processing or none at all, and supplies for export-oriented industries which require more processing. In these cases, a fast growth of the home market might limit the development of agroindustries unless total production is increasing at a sufficiently rapid rate. Along with the growth of foreign marketing will come the need to know foreign tastes, and also the need to comply with rigorous quality standards and sanitary processing requirements. Agribusiness can make a useful contribution in these respects.

The view used to be held that agribusiness in Latin America could only be profitably pursued on a large scale. It would follow that only large commercial plantations might offer opportunities for the establishment of profitable agribusiness operations. The resulting increments in income would therefore be confined to large landowners, individual or corporate. However, there are other possibilities.

Subsistence farming occupies about 70 percent of the rural population in Latin America; most of these farms are minifundios, poverty-stricken single-family operations that do not produce for the commercial market and remain outside the periphery of the economic process. The minifundistas, which amount to one-fourth of the economically active population, own only 2.4 percent of the land suited for agriculture. In the Inter-American Development Bank, we believe that one of the great challenges facing us is to help the masses of small and medium-sized subsistence peasants graduate into commercial farming. In order to achieve that goal, we must, among other things,

promote collective action among the peasants, so as to utilize the benefits of economies of scale in agribusiness enjoyed by economically viable, larger estates. In most of Latin America peasants are not effectively organized, and they have little or no negotiating power vis-a-vis other sectors of the economy. They tend to draw the short end of the stick in dealing with intermediaries selling their products, or in procuring inputs needed for the operation of farms. They must be protected and organized.

Cooperative organization is the key, and such organizations should handle both marketing and credit. Group credit facilitates the achievement of economies of scale, effective credit management, and the introduction of new technology. These improvements can make possible a more equitable distribution of income among farmers. The most effective interaction of the capital and market functions is to be found in multi-purpose groups, including those based on collective land tenure models such as exist in Mexico, or integrated commercial cooperatives such as the Japanese have developed in Brazil. Group credit can be combined with cooperative marketing and also farmers' supply arrangements, especially through second-level cooperatives. As agroindustry develops and expands throughout Latin America, a strong cooperative framework will permit important strides forward in the direction of fostering technological innovation for small farmers.

Prospects for Agroindustries in Latin America

At this moment there is in Latin America a favorable climate for the development of agroindustries. There is a growing demand for the output of agroindustrial systems, due to increased population, levels of income and the urbanization process. Within the countries of the region there is evidence of increased government attention to agribusiness in general, due to its important linkage effects and its labor-absorptive capacity. The establishment of agroindustries in many parts of Latin America is facilitated by the relatively advanced stage of cash crop agriculture.

An added incentive for agroindustries in Latin America lies in the heavy investments being undertaken by governments in the required physical infrastructure such as transportation, storage, irrigation facilities, education, electricity and preinvestment financing. This effort is in turn bolstered by widespread governmental support to improve agricultural inputs, and by the expansion of training, research and extension programs, as well as by credit facilities for small and medium farmers. Government expenditures for agriculture are supplemented by those of international financial agencies such as ours. A total of 174 loans made thus far by the IDB in the agricultural sector, amounting to \$1.5 billion, helped to finance projects worth \$3.7 billion.

Against this background of governmental expenditures supplemented by multilateral sources, agroindustries established in Latin America tend to have high rates of return. They provide excellent opportunities for low-risk investment as well as for marketing machinery, plant equipment and know-how, produced in capital and technology-exporting countries. The growing uncertainties in supplies and occasionally serious shortages of grains and oil-seeds, such as the world is experiencing today, make it imperative for the industrialized nations to diversify their sources of imports. Current readjustments in world trade impel producers and consumers alike to search for new clients. The Latin American markets may be large enough to justify construction of an efficient size of facilities, even for production intended solely for a home market. Regional economic integration will in any event expand the markets for Latin American agroindustries.

The Role of Private Investment in Agribusiness

Private investors can make a substantial impact on the development of agribusiness in Latin America through the provision of capital, technology, management know-how and marketing skills. Domestic private investment in plants for the transformation of agricultural products is not sufficient, however, if the financial structure is not likewise improved. Profitable opportunities do not by themselves generate social innovation. So far only Brazil, Argentina, Chile, Colombia and Ecuador have institutions such as cooperative development funds or banks, and their capital base is generally very narrow by virtue of limited access to funds from which to increase their equity and loanable capital. However, if these cooperative financing institutions could obtain capital by the sale of either securities or debentures to private concerns such as agribusiness firms, in exchange for one or more seats on their boards of directors, the capital base of the cooperative movement could be rapidly expanded and thereby make the introduction of technological change more effective.

One of the more interesting recent developments in the growth of agribusiness in Latin America with the participation of foreign private capital is the formation of enterprises with multiple ownership. By way of example, let me mention LAAD, the Latin American Agribusiness Development Corporation, S. A., with an authorized capital of \$15 million, whose shareholders comprise 13 leading United States industrial and financial corporations which have joined forces to stimulate the development of small and medium-sized agroindustries in Latin America, both by building up their domestic and foreign marketing capabilities and by broadening their ownership among local investors. This particular company's Central American subsidiary, based in Guatemala City, has an authorized capital of \$3 million of which two-thirds have been subscribed by the parent firm, with the

remaining million to be placed among Central American investors. Being — quite literally — "seed" money, its policy is to divert its equity holdings over time, preferably within the local capital market. It will entertain applications for financial participation in eligible agribusiness projects, including combinations of equity, debt, convertible debt and guarantee commitments; as an equity investor, it prefers joint ventures and restricts its participation to minority holdings. I am convinced that there is room for more such pioneering ventures.

Private investment can be a very significant vehicle for the transfer of technology to Latin America in the field of agroindustry. It is often alleged that much of the agricultural research needed for the development of agribusiness has already been undertaken in the industrialized countries, and that therefore this is an area undeserving of high priority in the developing nations, including those of Latin America. It ought to be recognized, however, that much of this research tends to be location-and/or climate-specific, i. e. applicable only to those countries in which it is carried out. Most of the Latin American countries are located in the tropics and produce agricultural commodities under conditions quite different from those prevailing in Western Europe and North America. The momentum of the Green Revolution has slackened; while international research centers have performed with great distinction, for instance by developing new hybrid wheat strains as CIMMYT did in Mexico, the pressing need now is for institutionalizing such technological innovation.

It simply is not realistic, however, to assume that the public sector should always pay for feasibility studies intended for agroindustrial development. Only a few governments, such as those of Argentina, Brazil and Mexico, have the means to undertake such studies. It would be more equitable for foreign entrepreneurs to share the cost of such research, especially when there are indications of a large potential consumer acceptability for new products. I venture to suggest that research is needed in the greater utilization of products that might find profitable markets in the industrialized countries, such as cassava, mangoes, papaya, plantains, and so forth. But even in familiar cash crops modern research can achieve impressive results. Consider the case of sugar cane, for example, which produces much more than sugar; recent experiments in Cuba and the Dominican Republic show that cattle can be adequately fed on rations containing 70 to 80 percent of molasses, thereby resulting in huge land savings and in better prices for cane by-products.

To take advantage of new opportunities for growth in agribusiness, there is a need for a continuous, institutionalized flow of new technology. This flow should include research as well as training facilities and vocational education for the building up in each developing country of a critical mass of skilled personnel. In order for Latin American agriculture to produce food, fiber and fodder in the quantity and at the level of quality required for both domestic consumption and export, there may well be a need for applying to agroindustry within the region assembly-line efficiency

techniques normally applied to industry. It was thought until recently that science and technology made it possible only for the large corporate structures, generally of foreign origin and most of them multinational in character, to operate efficiently in agroindustry. This is due both to these firms' ability to mobilize capital and to their streamlined management, as well as to their greater sensitivity and consequent ability to respond quickly to fluctuations in world markets. Nevertheless, new technologies and products have emerged which are suited to much smaller producing units placed nearer the sources of supply, such as slaughterhouses and oilseeds mills. Thus, in Colombia the Central of Agrarian Reform Cooperatives (CECORA) promoted, tested and financed a series of new specialty crops, to the ultimate benefit of its members.

Research can be oriented to reproducible or manufactured inputs, of which the most basic ones are feeds, fertilizer, pesticides, insecticides and machinery adaptable to the scale of farming prevailing in the minifundia environment of Latin America. With the exception of Japan, very little has been done by agribusiness anywhere in this field. Machinery suitable for small and fragmented land holdings is needed. Failure to develop agricultural technologies consistent with the high population densities in rural areas may ultimately prove to be extremely costly. The kind of research recommended here needs to be done in the countries where it would be used. What is needed is a lasting partnership with the foreign firms which would allow sufficient time to transfer to the local users an entire technology package that will support a sound overall agribusiness venture.

One example of this approach relates to PROLACSA, a joint venture of Nestlé with Nicaraguan dairy farmers and investors, initiated about five years ago to open up profitable outlets for additional milk produced by beneficiaries of a partially IDB-financed dairy livestock development loan, and to supply the Central American Common Market countries with powdered milk previously imported from Europe. Most of the capital for hardware was provided by a line of industrial credit partially financed by IDB. The transport of raw milk was facilitated in that the Bank also helped to finance a market access roads project. Nestlé adds the catalytic ingredients of transferring to Nicaragua the production know-how at the farm as well as at the plant level, and contributes the marketing know-how by serving as exclusive sales agent in Central America for the output of the plant under its world famous brand name. As of now the only foreign national at the PROLACSA plant is the general manager, a Spaniard "third generation" Nestlé man. All the rest of the employees are Nicaraguan nationals. Furthermore, Nestlé is a minority stockholder, gradually selling its equity participation to local investors and dairy farmers. Nestlé's imaginative project, already running at full capacity three years before scheduled expansion, has created a prosperous agribusiness package out of apparently disconnected livestock loans, an industrial credit line, an access road project and Central American Common Market "integration industry" provisions.

It is not primarily the shortage of funds that tends to slow down development of small and medium-sized agribusiness ventures. Rather one of the main barriers lies in inadequate communication and the failure to appreciate national sensitivities. As a result, foreign corporations may encounter difficulties in devising agribusiness ventures that are viable from a political and technical as well as from a financial standpoint. As development bankers, we in the IDB must be fully aware of this communication gap, and indeed we are attempting to bridge it. The Bank is engaged in a major effort at providing managerial talent for agribusiness, if only to assure that once the physical facilities are completed they will be run in a businesslike fashion. The IDB is now sponsoring a pioneering program designed to strengthen training in agribusiness management in Central America. Moreover, IDB and the World Bank have joined hands to offer, by mid-1974, a nine-week pilot course in identification, preparation, evaluation, execution and administration of agroindustrial projects in Latin America. We hope that the material generated for this pilot course will help establish a basis for initiation and successful execution of many agribusiness ventures in the region.

Today's international markets offer opportunities to export nontraditional processed and semi-processed agricultural products. Because of the size and complexities of marketing internationally, many Latin American producers are not taking fullest advantage of their export potential. Most producers of agricultural products do not individually control the volume necessary to serve today's international mass markets. However, much can be done to link these producers to their markets through multi-producer marketing companies which can distribute the output of several production sources. Other methods are also available which encourage a more integrated approach to international marketing opportunities.

The Bank's past efforts to promote agricultural development have tended to focus on production aspects. In recent years a more balanced view has come to prevail. Indeed, last year a study was made of investment policies for certain projects in agricultural marketing. It concluded that the several joint ventures involved, including strictly private sector projects in dairy farming, poultry processing and vegetable exports, were excellent mechanisms for overcoming deficiencies in managerial and technical expertise among farm groups. It was found that investments in agroindustrial facilities and agricultural marketing are required in order for the major benefits of agricultural or infrastructural projects to fully materialize. The success of investments in increasing the output of a particular product depends to a large extent on the structure of investments in supplementary lines and in the corresponding distribution system.

[Extracted from an address to the International Conference on Science and Agribusiness, London, England, February 20, 1974.]



COMMUNICATIONS MEDIA

TURKS CLUSTER AROUND RADIO
TO HEAR NEWS BROADCAST IN ANKARA
(PHOTO: U.S. AGENCY FOR
INTERNATIONAL DEVELOPMENT.)

Communication in Development

Everett M. Rogers

[At present, the mass media play a major role in creating a climate for modernization among villagers, but are less important in diffusing technological innovations — although their potential for doing so is high. Mass media channels are especially effective when combined with interpersonal channels, as in media forums; and the traditional mass media, such as village theater and traveling storytellers, have an important potential for development purposes, especially when they are combined with the modern electronic and print media.]

What is the role of communication in facilitating development in less developed nations? In order to answer this question, one must distinguish between: (1) mass media and (2) interpersonal communication channels. Mass media channels are all those means of transmitting messages — such as newspapers, magazines, film, radio and television — that enable one or several individuals to reach an audience of many. Interpersonal channels are those which involve a face-to-face message transfer between two or more individuals who may be family members, neighbors and friends, salespeople, schoolteachers, government change agents or others. In comparison with interpersonal interaction, mass media communication is generally distinguished by: (1) the larger potential size of the simultaneous audience which can be reached; (2) the difficulty of obtaining feedback from receivers; (3) an interposing between source and receivers; and (4) lack of mutual source-receiver surveillance, because neither source nor receiver has much direct control over the other.

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Mass Media in Diffusing Innovations

Research evidence on the diffusion of innovations in less developed countries generally indicates that interpersonal channels are of much greater importance than mass media channels. For instance, Rogers and Svenning reported that not one of their Colombian peasant respondents utilized any mass media channel in their innovation decision about 2,4-D weed spray. Similar studies in Colombia, Mexico and Pakistan show that mass media channels are seldom reported by respondents in developing countries at any stage in the innovation decision process. This contrasts with research evidence from the United States where mass media channels are of considerable importance in diffusing innovations. How can this difference be explained?

Limited exposure. In less developed nations the mass media reach much smaller audiences than in more developed countries. For instance, in less developed nations about one-third of the village households do not receive any of the mass media, about one-third is reached only by radio and roughly one-third is in the audience for both the electronic mass media, such as radio, and the print mass media, such as newspapers and magazines. The availability and cost of the mass media — in addition to the barrier of widespread illiteracy — act to limit exposure to the mass media. An important trend, presently underway, is the expansion of mass media audiences, especially of the electronic media; in countries such as India and Brazil the future may hold a much greater promise through satellite television.

Message irrelevancy. The potential of the mass media is also being limited by the content of the messages it carries. Content analyses of the mass media in less developed countries show that most message content is either intended for entertainment purposes or is irrelevant to the information needs of rural, nonelite audiences, being devoid of "how-to" information about innovations in agriculture, health and nutrition, family planning and community development. Moreover, the backgrounds and training of the mass media communicators do not prepare them to produce messages effectively for their mass audience; a wide cultural gap between producers of programs and receivers precludes effective communication. Finally, private mass media institutions which depend on advertising support are not motivated to appeal to potential listeners and readers whose subsistence position places them on the edge of the market economy.

Low credibility. Another problem is that the mass media are often perceived as relatively low in credibility by the mass audience in less developed nations. One reason is that there is often a high degree of government control over the mass media, especially the electronic media. National governments in less developed countries are active promoters of development activities, and these governments

use the media as integral tools in their development campaigns. Much of the content in all of the media, including advertising, is propagandistic in nature, designed to inform or persuade people about various kinds of modernization. The pro-modernization theme of the mass media in less developed nations is at least partly a result of government control, a control which leads the media to speak with one voice, which also contributes to their relatively lower credibility in the eyes of the receivers.

If the mass media messages are so predominantly promodernization in nature, why are these media not of importance in diffusing innovations? Mass media exposure is able to create a generally favorably mental set toward change, but is seldom able to form or change specific attitudes toward innovations — a task better accomplished by interpersonal communication channels or by a combination of mass and interpersonal channels. Mass media's role at present is mainly to achieve a climate for modernization rather than to provide specific details needed for the adoption of innovations.

The climate for modernization. The climate for modernization, the knowledge, attitudes and beliefs and behavior which constitute a favorable mental set toward change, is not synonymous with the adoption of innovations. Such adoption is one consequent act stemming from prior development of a climate for modernization. The mass media of communication are especially able to raise the level of aspirations of citizens in developing countries. The media preach the gospel of desire by depicting the good life in advertisements and news stories; this raises the "wants," but the mass media are less able to provide the "gets" of development, such as increased farm production, higher incomes and the teaching of literacy. As Daniel Lerner pointed out, the wants-gets ratio becomes lopsided; thus, citizens' frustration with development may become widespread — perhaps resulting in political instability and other consequences, which in turn interfere with development even further. Yet, by increasing the wants, the media are at least contributing toward a climate for modernization.

The problem with achieving higher levels of development through creating a climate for modernization is that it is relatively slow. Can the potential of communication in development be achieved more expeditiously?

Combining Mass Media and Interpersonal Channels in Media Forums

We have pointed out that the mass media alone have played a disappointing role in diffusing technological innovations in less developed nations. However, the potential of the media is great if they are

used in a complementary combination with interpersonal channels. One type of such channel combination is the media forum.

Media forums originally developed in Canada among farm families and later spread to developing countries, such as India, Nigeria, Ghana, Malawi, Costa Rica and Brazil. Media forums are organized small groups of individuals who meet regularly to receive a mass media program and discuss the contents of the program. The mass media linked to the forum may be radio, as in Indian forums or the radiophonics schools of Latin America, or television as in the Indian teleclubs.

Undoubtedly, the largest, most thoroughly researched media forum program today is India's, representing "a degree of experience with the radio rural forum unequalled in the world." Regularly scheduled radio programs beamed at meetings of forum members gathered in homes or public places to hear the broadcast serve as impetus for the group discussion which follows. The forums usually provide regular feedback reports of decisions and questions for clarification to the broadcaster. Using the same format, but exchanging the radio for television, the United Nations Educational, Scientific and Cultural Organization (UNESCO) has sponsored experimental television listening groups in France and Italy, and a teleclub program is presently underway in villages near Delhi.

Media schools attempt to provide a basic education, including literacy training, for people living in remote rural areas. Radiophonic broadcasters of Colombia and eleven other Latin American nations intersperse their lessons with news, agricultural programs, religious training and music. Each school group of eight to twenty students is led by a trained monitor who helps the students learn and regularly encourages them to listen.

In all of these various types of media forums some form of mass media communication is combined with the impact of interpersonal communication in small groups. The group seems to be an important element in moving the individuals toward greater acceptance of the innovation messages being transmitted through the mass media. The media forums are used primarily in less developed countries to introduce new ideas to vast audiences — audiences which could not be reached for decades if development campaigns relied entirely upon the interpersonal activities of change agents, such as extension agents and community development workers. So, the media forum approach offers great potential for multiplying the impact of either the usual mass media alone or the ordinary change agent approach.

Effects of media forums. Although there are important country-to-country and program-to-program differences in the types of media

forum systems which have just been reviewed, they possess certain common elements. All utilize a mass medium — radio, television or print — to shoulder the major load of carrying messages about technical innovations to the discussion forums. All feature small-sized groups, which are exposed to the mass media channel and then participate in discussion of the message. All of the media forum programs seem to be generally effective in creating knowledge, in forming and changing attitudes and in catalyzing behavioral change. Yet, adequate scientific evidence of these media forum effects is rare. What research has been done emphasizes that the effects of mass media communication channels in less developed countries are greater when these media are coupled with interpersonal communication channels in media forums.

There are also reports of difficulties experienced in many national forum programs. For example, Indian government inspectors have usually confessed some disappointment in their official evaluations of the forum program: "The trouble is not with the forum pattern itself, but with the way it is being operated." Forums require continuing attention from professional organizers; forum members drop out; the radios break down or their batteries are exhausted. Radio forums do not run themselves. Nevertheless, Indian radio forums have been steadily increasing in number; they enroll over a quarter of a million villagers.

Why do individuals learn more when they are members of media forums? First, attendance and participation are encouraged by group pressure and social expectations. Attitude change appears to be more readily achieved when individuals are in groups. Furthermore, group decisions are more likely to be accepted by the individual if he participates in making the decision; usually, this occurs in the media forums. Feedback to the broadcaster from media forums is provided for and is comparatively fast, which leads to greater efficiencies in the operation of the broadcasting institution and to greater receiver orientation.

Traditional Mass Media

One of the first signs of modernization in a society is the lengthening of communication channels. Villagers begin to travel to metropolitan centers, and the electronic mass media begin to reach out to larger audiences. However, one should not forget that in most less developed countries there is already a far-flung network of mass media channels which existed long before the print or electronic media.

These traditional mass media include such channels as folk theater, traveling storytellers, balladeers and poets. These channels are

traditional in that they were long a part of the culture, but their messages may be either modern or traditional. Thus, they have great potential as tools for development. A particular advantage of the traditional mass media is that they are long-established and well-accepted. In contrast, the modern mass media are themselves an innovation — a change which must be accepted before their messages can have an impact. Strangely, development planners have generally ignored the potential of the traditional media and restricted their thinking only to the modern mass media, when, in fact, the modern and the traditional mass media are often functionally interrelated. For example, Roberto Benjamin found that cantadores — singing poets in northeast Brazil — act as an intermediary in the two-step flow of communication by learning new ideas from the modern mass media and passing these messages along in poetic form to villagers.

Another possible interrelationship between the traditional and modern media is found in several countries: a traditional program may be broadcast on a modern media channel. For example, a village theater show was regularly carried by the government radio station in Nigeria. Similarly, All-India television broadcasts a traditional puppet show. In both of these illustrations some modern ideas, such as chemical fertilizer and family planning, are included in the message content of the traditional program. Family planning campaigns have probably made the most use of traditional media to diffuse innovations; plays, songs and traditional instruments have been used to promote contraception in Indonesia, Pakistan, Iran, India and many other nations.

The traditional media can carry modern messages, but if the media are not transformed in a gradual and constructive way, the whole effort may fail. There is evidence of this important point in the Chinese experience. Prior to 1949 there was an extensive network of traditional media, consisting of village theater, storytelling and ballad singing. When the Communist government came to power, it insisted that the traditional mass media channels immediately drop their traditional and mythical content and switch to political messages. Furthermore, the number of storytellers, singers and performers was greatly increased in a short period; within ten years there were an estimated 280,000 song-and-dance troupes. Their professional skill was often low, and the Peking government had to enforce listening in order to gain adequate audiences. The net result was that Peking severed the traditional media from the people. Instead of introducing new ideas to the peasants, the political leaders alienated them. After rapid physical expansion the traditional media bogged down in unpopular products.

A parallel conclusion is reported in the case of an Indian village when certain modern ideas were introduced in the traditional media. John Gumperz describes a play about community development where

the villagers criticized the theme; they perceived it as inappropriately coming from daily life and having no connection with mythology. So, the audience was negative and hostile, and many walked away before the end of the performance. In contrast, a traditional Arya Samaj singer used bhajan music for songs about public health and rice cultivation innovations. "His activities have been known to hold an audience of several hundred in bitter cold winter weather." This particular singer was employed by government change agents to diffuse innovations because of his professional ability as a singer and his popularity with village audiences. Thus, he represents an effective traditional channel in carrying modern messages.

The traditional mass media have not received their just due from development planners, in part because they are difficult to control, at least in non-Communist countries. For instance, the village theater of South India often portrays strongly antigovernment themes; and the shadow theater of colonial Indonesia was anti-Dutch.

The traditional media may be especially able to narrow the communication effects gap between those audience segments which are relatively high and those which are low in socio-economic status, because the traditional channels can reach the less advantaged individuals in a society. Recent communication researches suggest that most attempts at change-oriented communication over time tend to widen the gap in effects variables — such as knowledge, attitudes and overt behavior — between the subaudiences who are high and low in socio-economic status. Thus, the traditional media may be uniquely capable of contributing toward the second dimension of development: that of a more equitable distribution of development benefits to the rich and poor in a society. However, our main point remains: the traditional media have a great potential in achieving development goals because they have a wide audience and high credibility in the eyes of villagers.

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Television Programming in Dakar

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[From 1964 through 1969 UNESCO sponsored a project in educational television for women in Dakar, capital of Senegal, reaching 250-300 women organized in 14 teleclubs. This article describes methods employed to develop programs in the Wolof language, using limited equipment, that would best meet the needs of African city dwellers.]

On entering the headquarters of Radio Senegal at Dakar, there is little to indicate that this is a television station. Yet if one penetrates into the courtyard and takes the right hand entrance to the next building, one finds a converted radio studio housing the three vidicon cameras mounted on wooden tripods and operating under a bank of overhead lights. The microphone is held by means of a bamboo perch and the sets are almost permanently installed along the walls of the 75 square meter studio. A control room, a small announcer's studio and film projection and editing facilities complete the installation, except for a small store room for sets and graphic art, a room equipped for technical maintenance, and an office. Not even a mobile unit is available. To get at the outside scene, 16 mm film is used which must be processed in Paris.

Foreign visitors, including those from other African countries which have introduced television, who are acquainted with professional standards of television production cannot fail to have doubts about the efficacy of this small television station. Yet the very limitation of facilities has been a major factor in promoting the use of television in an entirely African way, that is close to the people and without any pretension to rival the glamor of television in highly developed countries. Limitation of resources need not necessarily mean lack of professionalism in production or flexibility in the use of equipment. But these facilities never even attained the

optimum of a small television station. The rigid tripods made smooth movements almost impossible; the rudimentary sound facilities often made it more difficult to cover the scene audio-wise than to pick up the image; lack of flexibility in lighting, the absence of film developing facilities, and of course the frequent breakdown of the video recorder, all these were obstacles to productions of good quality. Both Senegal and UNESCO were keenly aware of the shortcomings of the available facilities; but budget limitations were serious.

On the other hand, much larger resources might have had a serious negative influence on a project whose primary purpose was to show what could be accomplished within the actual limited conditions of Senegal. This limited infrastructure demanded considerable ingenuity and resourcefulness from technical and programming staff alike. Rather than concluding that because installations were simple programs would have to be likewise, the small Senegalese team, aided by a single UNESCO expert, ventured into drama, entertainment, and graphic and photographic illustrations. The greater danger might, in fact, have been an effort to attain a technical perfection which would have required not only staff qualifications beyond those available but a type of operation in which the technique, the "hardware," would have dominated instead of remaining the pliant tools for African content and form. The basic issue arising in connection with television was, and remains, whether this medium of communication brings with it inevitably the style and program content found in Paris, London or Los Angeles, or whether it can reflect the material and cultural needs of the African continent.

Television In The African Context

Although the Dakar television project was limited geographically, as well as in time, resources and subject matter, it has thrown fresh light on the problems and opportunities of the medium in the African continent. Since the purpose was educational, the audience had to be popular, the conditions of reception suited to their means, and the language that of the people. But much the same constraints would have affected a more generalized television service, had its *raison d'être* been to provide a medium of communication with and for the people of the country. The issue of educational versus generalized television becomes crucial only if the starting point is the audience which can pay for home receivers and is culturally more attuned to Western society and language.

Television for this small minority might seem economically more feasible, but it would have doubtful social and cultural values. It would inevitably have to resort to heavy advertising. Since advertising can generally be paid for only by the larger enterprises which are usually foreign-owned and frequently engaged in the import of

foreign products, the impact of commercially sponsored television is likely to strengthen dependence on foreign capital, to reinforce an unfavorable balance of trade, and to waste essential capital on luxury consumption. Television for those who can pay for it tends to polarize society, both socially and culturally, and to hamper economic development based on national initiative and resources.

The alternative road chosen by the pilot project avoids these pitfalls. But it also implies that television cannot be expected, at least initially, to pay for itself. Television becomes a service to society, on a par with education, health or public administration. It can be justified only through the indirect benefits to society, through greater productivity, better health conditions, improved education, and increased cultural, as well as political unity and self-awareness. Neither programs nor reception can reach a satisfactory level unless heavily subsidized from the start and aimed at a broad audience.

Long-term public investment without expectation of immediate revenues is generally accepted in the public services referred to above and in such installations as roads, railroads and dams, or in the preservation of cultural treasures. When it comes to film and television, however, different standards are usually applied. Their background in developed societies as fields for commercial enterprise and the provision of entertainment leads governments of developing countries to ignore their social significance, to waste their vast educational potential, and to expect them to pay for themselves. Furthermore, the conclusion is frequently drawn that television programs must largely be imported since not much can be produced on the spot by purely African staff. If this pilot project has achieved nothing else, it has at least given the lie to that notion.

When Nigerian television began at Ibadan, it proudly chose as its slogan "First in Africa." Television has become a symbol of prestige and a source of entertainment in many African countries. It is a force of mass communication in the Arab states and has reached nation-wide dimensions in the Ivory Coast and Uganda. The thirst for television is a groundswell in the world of today. African populations are no less eager to see this new and fascinating medium of communication. Is it surprising then, that the Government of Senegal decided in 1963 to introduce a generalized television service? President Senghor's veto and his option for a purely educational and cultural television of largely African origin went against the stream. The experience of the pilot project has reinforced his position by showing that in fact there does exist an African alternative, though at a price. It is this price, and the uncertainty about its benefits, which has prevented the Government from continuing and extending the experiment conducted under the auspices of the pilot project.

The prevailing tendency in Senegal today is to seek a nationally oriented television system. Such a system would broadcast both in French and in national languages in an attempt to reconcile the needs of internal development and participation with the interests of the French-speaking community and the importance of communication with the rest of the world. In such a national system there is an important place for foreign productions and films which are valuable from cultural, social and informational points of view, since television can never limit itself to a purely national horizon. In a small, relatively poor country, television suffers inevitably from restricted funds, and is therefore on the lookout for low-cost programs from elsewhere. The crucial issue is whether such handicaps impose a largely foreign-dominated program, or whether it is nevertheless possible to establish a television which is predominantly African and meets major national needs. The President of the Republic has made it clear on numerous occasions that he seeks the second alternative.

The Content of Urban Television in Africa

The pilot project was in no way an attempt to set the pattern for a complete television system. Even in the field of education it excluded service to the formal educational system. Yet within these limitations, it indicated important avenues for the future.

The initial programs on health and nutrition were gradually broadened, as is apparent from the following table:

<u>Subject</u>	<u>1965</u>	<u>1966</u>
<u>Health-Hygiene</u>		
Sanitation	6	0
Parasitic diseases	4	0
Other diseases	13	4
Gynaecology	6	2
Vaccinations	4	0
Personal hygiene	3	1
Total	<u>36</u>	<u>7</u>
<u>Nutrition</u>		
Weaning	8	2
Diet	15	3
Total	<u>23</u>	<u>5</u>

Sciences

Physiology	5	2
Psychology	0	6
Other sciences	0	2
Total	<u>5</u>	<u>10</u>

Miscellaneous

Civics	4	12
Home economics	0	2
Household	3	2
Religion	0	4
Television games	1	4
Programs prepared by teleclubs	1	2
Total	<u>9</u>	<u>26</u>

TOTAL, programs broadcast 73 48

Although the table indicates that considerably fewer programs were broadcast in 1966 than in 1965, the total number of viewing hours in each of these two years was much the same.

1968 saw the production of a very interesting series of five programs dealing with legal institutions in Senegal and, more particularly, with the administration of justice at the village, departmental, regional and national levels, and with the subjects of divorce, desertion, theft and the Constitution. Another series, on the subject of children of school age, included: an introductory program in which a television audience of women spoke of their problems, followed by programs entitled "Going to School," "School Children at Home," "Parents and the School" and "Schools in Senegal." The next series, entitled "Woman and Home," consisted of two programs on furnishing the room and two programs on equipping the kitchen, together with a program on life in improved accommodations. Members of the public participated actively in these series: the first and final programs of each series involved live discussions among women in the studio audience.

The most interesting productions in 1969 were three experimental programs for young people. The first, on the subject of marriage, asked the question: should a young man bow to parental authority and accept the wife chosen for him by his father, or does he have the right to follow the inclinations of his own heart? After this experimental program had been screened in four teleclubs, the pilot project organized a number of meetings between young people, with the aim of

selecting subjects for future programs. These meetings provided a score of subjects for programs conceived and written by young people. Thus, the second program, entitled "Is he responsible?" was devised by young people in Camelia. Similarly, the third program, entitled "Young People of Pikine" was produced in collaboration with young people; a dramatic sketch was followed by a debate between a number of young people from Pikine and representatives of other youth groups in the Dakar area.

By concentrating on subjects of direct concern to the audience, the programs aroused intense interest and led to a continuous dialogue between specialists and the public. Emphasis was placed on subjects in which the individual family could take action within its economic limitations. How to build furniture out of orange crates, how to wean babies earlier by substituting home-made baby food for mother's milk, how to enhance personal hygiene through greater care and better knowledge of your own body, these were subjects of wide interest and effectiveness. Similarly, programs about excessive expenditure on weddings and baptisms, about the danger of traffic accidents and the civic responsibilities of the citizen sought to enable people to cope better with the realities of daily life.

But there is a limit to which the individual, or the local community, can help itself without the assistance of the administration. The ignorance of the average citizens of Dakar, many of whom have only recently migrated from rural areas, about the various public services which are at their disposal to deal with the many painful issues of daily existence as well as with the education and vocational orientation of young people is a fact of life in the sprawling city. So is the relative remoteness of officials from the people whom they are to serve. Evidently what is needed is not only dialogue but also the means to correct at least the most glaring deficiencies of urban living. Much can be done even within present restrictions, if only all partners will work efficiently and self-help is coupled with government assistance.

One of the most striking elements of the modern Senegalese city dweller's mentality is that he has come to expect to be taken care of by the State and the municipality, and thus puts his rights before his responsibilities. While rural populations rely on their own meager resources for production and self-improvement, city-dwellers are more concerned with their rights than with the needs of development, and find it very hard to realize that development will not come about by magic but must, at least in part, depend on their own ability to organize themselves and to invent and implement processes of change for themselves. It is not enough, however, to rely only on localized motivations or organization. There is even a danger of ending up with anarchical and useless structures. Outside the district where he lives

or has his place of work, beyond the city whose full significance he has yet to perceive, the adult needs a clear-cut and solid frame of reference against which he may measure himself. Every educational effort in an urban context must be based explicitly on a "national will" as well as being entrenched at grass-roots level in the city.

A concrete example of what can be done is shown by one program, The Cradle Song, broadcast for a mixed audience of men and women in the evening. It began with a dramatic sketch, played with much laughter and vivacity, in which the wife tells her husband that she asked some neighbors over to show them the shelves, cradle and other furniture which he has built. He proudly shows his guests around his home and explains the cost of the materials, how he has found them and has gone about making the furniture. All examples were taken from furniture actually made in the Centre d'Enseignement Technique Feminin, and the prices were accurate under local conditions. During this half-entertainment and half-instructional program, four cradle songs of four different ethnic groups were sung against typical Senegalese backgrounds. Every member of the audience identified with one of the songs and there were tears in the eyes of young men in the packed teleclub in which I watched the program. By bringing together in one program these four songs, television enhanced a sense of unity and a feeling of mutual respect.

Style of Production

Key to the value and character of television, to its roots among the people and significance to education, is its style of production. The pilot project was essentially an exercise in an African style of television. All its activities, from training through production to reception and feedback, were aimed at this central purpose.

When Owen Leeming, a New Zealander with wide experience in radio, theater and television, arrived in Dakar at the end of 1964 as the sole UNESCO expert in television production, he found a small staff of technicians, directors and cameramen, some of whom had received training in France. Yet this training was far from complete or adapted to the conditions at hand. The gifted electronics engineer had acquired all his knowledge of television from books. The cameramen were not used to the difficulty of using rudimentary equipment to catch the unexpected movement of actors who moved along without the firm control of a script. The directors had to forego the egotism of self-expression through the medium and apply themselves to interpreting the conditions and preoccupations of the audience to whom they were addressing themselves. And all of them lacked experience. Leeming's first task was to set up training courses appropriate to the specific conditions on the spot.

Since the purpose of the television project was not entertainment for middle class audiences, but adult education for the people whose

vernacular language is Wolof, programs had to be produced in Wolof. This basic decision henceforth distinguished Senegal television from African television stations which broadcast only in the administrative language of the country.

As Leeming put it in an interview given in 1971: "I think the first important decision was to use the local language as the vehicle and not French. Everything else flowed from this. Wolof, the majority language of Senegal, is not a written language. It can be transcribed but there was as yet no universally accepted transcription. So, we had to proceed from a written language, French, to an unwritten language, Wolof. I think that this is probably true of many developing countries. Television, with its script requirements and all its written infrastructure must somehow find the bridgepoint to pass from the written to the unwritten language. "

The solution adopted was to prepare an outline script in French, with appropriate transitions from scene to scene, from one program segment to another, and introducing the film sequences. This script was handed to the performers, be they actors, specialists or invited guests, who then followed it roughly in Wolof. Hence producers and performers had to be fluent in both Wolof and French, a reason why it would have been impossible to employ anyone operationally who was not Senegalese. The only foreigner who was part of the production team was the able young French stage and graphic artist whose art was strongly marked by his long experience of life in African surroundings. The UNESCO expert happily limited himself to constructive criticism, and applied his tactful hand to overall guidance of the operation.

As time went on and audience participation in programs grew, the little plays presented to highlight social issues were conceived and elaborated by amateur theatrical groups and the teleclubs themselves. Since this took place in Wolof, the elaboration of a television script involved a further step, the translation from spoken Wolof into written French, to be once more readapted to spoken Wolof as the actors presented the play to the television cameras.

To the Western mind, education and television normally imply organization, mental and practical discipline, conciseness and planned purposefulness. But this view is quite foreign to the culture of the people who were to find expression through the medium in Senegal. As Leeming observed: "We had to speak in French and think in French when we trained people to the point where they were able to go over into Wolof for the actual programming, the actual transmission. This sometimes worked; sometimes it did not work because I think an unwritten language is much less disciplined than a written language, much less concise. " There was a constant risk that programs would be drowned in verbiage, while the visual potential of television, the

educational power of images, would be neglected. To counteract this tendency required all the sophisticated techniques offered by television: animation, and the use of the image to convey essentials.

Lack of discipline and conciseness is simply another way of saying that the concept of time among the African people is not the same as that of Western man. Africans enjoy the tam tam for hours, or listen to the story teller and folk singer, to the griot who spins out his endless sing-song tale, whereas Western-minded producers or critics may be quickly bored. It is questionable, however, whether the "excessive" talkativeness of television programs was as tiring for the audience as it was repugnant to the television professional. In a civilization of oral tradition, long-winded explanations may be a good deal more acceptable than in the fast-paced Western world.

Timing also was a difficult issue in the production process itself. Since Dakar television was directed to teleclubs who gathered at a fixed hour, programs had to be transmitted at set times; and since the programs went out live, they had to be produced at a predetermined moment. As Leeming put it, timing was a constant constraint on production. "I discovered that in Africa, effective television has to be locally created, has to be live television which uses all the visual possibilities. And this is difficult television, it is heavily rehearsed television. It is television where people have to learn something new each time, so that there are definite imperatives in terms of studio time, rehearsal time and program preparation.

"I think it is difficult to say to people: you must be here at two o'clock, otherwise we can't have a program. People go home at lunch time, travel in crowded little busses which stop everywhere, and can't get back at two o'clock very easily. I wasn't a real stickler for punctuality except for camera rehearsals and live transmission. I was fairly strict at getting our programs out within five minutes of the announced time, because I knew that there were people flocking in front of television sets to see us and their interest diminishes with the length of wait. "

Quality is another concept which has a very different meaning to producer and audience. Many of the Dakar productions would be called "amateurish" by television professionals, and yet they satisfied the audience more than superficial slick performances. Again, Leeming's view is pertinent.

"I think from the point of view on the staff, they have to do good quality work, as good a quality as they can. But from the point of view of the audience you have a good program if you respect such things as realism and their rhythm of attention. I hate to see technical errors, a microphone or camera in the picture, a momentary interruption of sound or poor lighting. But I don't think people care as long as it's not so gross as to impair realism. The African women kept saying: 'What we like is things that are real'. Television gives the illusion that situations are real. The real includes, of course, their real entertainment and their

real laughter. The real isn't necessarily solemn or depressing. It is the real in all its shades, including the psychological reality which is the reality of the situations they know. "

Such realism is particularly important to educational programs, for education, if it is not attuned to their culture and mode of life, tends to be considered something foreign, not part of the people. In Senegal, people were still open to this kind of realism because their program preferences had not yet been distorted. As Leeming put it: "I think an audience that has already been corrupted, as it were, by imported television may have difficulty in going back, or going forward, to the television which is real. But we had the advantage of a completely unspoiled audience and their spontaneous reaction was just what I said. " Repeated consultation of the audience showed that entertainment for the sake of entertainment is rather resented. Not having been conditioned to the lure of gratuitous entertainment through television, the women of Dakar, like popular audiences elsewhere in the developing world, have a thirst for knowledge and education which makes them impatient with mere distraction. As one woman put it: "We have so much to learn that we have no time for seeing dances which we know anyway. "

Interestingly enough, the ultimate in realism was the drama presented by Dakar television. Drama proved educational in the deeper sense because it helped to open the minds, raising issues of direct personal significance and influencing attitudes and behavior. It was even possible to couple drama with instruction by including in the scenes statements by doctors or other specialists giving precise information on subjects introduced in dramatic form.

The popular theater of Senegalese television was not the product of professional script writers and actors, but sprang from the people themselves. Leeming describes the process: "In drama we used the local popular actors. They were not theater actors but people assembled by the griot, the musician. Because they had some experience in public entertaining, they were able to play in television productions, and also to incorporate hard educational content in their acting and to do situations they were familiar with. Professionals were used only rarely, for instance when a song had to be sung. We also used the members of the teleclubs and people who worked with us from the health and nutrition services. "

And how were the plays created, who did the scripting in an unwritten language? "We did what is now called collective creation. It's become fashionable since, but we did it without knowing what it is called. I, being from the outside, didn't know at the beginning what the conflicts were. So I would ask in the program meeting what the problems were. It might, for instance, be the problem of Ramadan [the Muslim month of fasting], the way the fast was conducted, since the eating habits where everybody gluttonized at night were in serious

conflict with good nutrition. We therefore had a basic idea: gluttonizing. And then I would ask all sorts of people present just exactly what went on. From this the big characters would start emerging, there would be the obese father, the children who were unable to eat but were submitted to his authority. So you get the situation, you get the characters. You have to add a little bit, which is, in fact, that bit of story which embodies conflict that needs resolution. So little by little, and with everybody chipping in together with all the small authentic details and pieces of character, things that are funny, things that are serious, you build up a little play.

"The story had to be invented, by myself or other people who are good at inventing stories. You could sometimes just suggest: - well, if you did this, what would happen? And somebody would tell you what would happen. If it was good dramatically, you keep that bit and you go on to the next. The actors also contributed, they would often have good ideas in the studio. But you had to give them a fairly precise idea of the basic situation, and of the characters they were to represent. And then sometimes you would find good new things to do. Often, of course, they got carried away with the situation and became too real, too involved to be held within the program and tell something specific. They would start to adopt natural time scales; this is, of course, bad for television and it would be necessary to compress. "

The production of popular theater in this impromptu and yet very deliberately oriented manner, calls for entirely different qualities of the producer than those normally associated with the profession. The starting point, in Leeming's words, is that "you must flee Western materials which are not well adapted to their public. You have to be the servant of the country. "

Asked how a producer should best prepare himself to be the servant of his country in television, Leeming answered: "I think there are two things he must do. First of all, he must perfect himself technically because of the many ways in which he will have to use television. And, secondly, I think he's got to democratize himself, to go back to his sources, the popular roots. He has to humble himself, to put himself in the minds of people and create from the ground up. At the same time, he must, of course, have an awareness of the educational build of his program, if he is working for an exclusively educational station.

"In general programming he must be dictated to by the cultural streams of his own country. He might find this difficult when he has been in Paris or London, and is likely to be exactly the sort of person who has been assimilated to a foreign culture. He must go back to the dance form, to the musical form, to the legends and to the concrete problems of his own developing country, the rural exodus and all the other problems which are hitting his country all the time. I think this is where he must find his material. I can't see a television, a proper television in a developing country, which is not subconsciously educational all the time, but in the best sense. "

Leeming has been quoted extensively because he brings out what appears to be the major problem in the use of modern media of communication in countries whose culture and social conditions are so very different from those where the media have built up their success. Film and television producers in Senegal and elsewhere either copy formats and subjects which they have seen elsewhere, or they look for new ideas in their own head rather than in the social reality around them which is alive with ideas and conflicts bursting to be brought into the open. A producer can serve communication only when he keeps his ear to the ground, when he is "humble" and follows the pulse of the people, rather than casting the style and content of the media into preconceived patterns.

The Audience

In urban Dakar, it was easier to group women around a television receiver than men, and they shared more common interests suited to educational programs. Women are the key to healthy living in the community through their influence on the home and the raising of children. To reach these women, for the most part illiterate, who come from different parts of the country but generally use Wolof as a common language, fourteen teleclubs were created in locations where a TV set could be installed and people could gather in the afternoon. Altogether some 250-500 women were reached directly by the programs, and many more were influenced through word-of-mouth transmission of the message received on TV.

Some teleclubs were installed in social or health centers; others used a room or a backyard where people could gather. Special locked cabinets were constructed to house the receivers and the key was handed to a local personality. The choice of location and the organization of the teleclub was entrusted initially to the "Service d'Animation," the government's Department of Community Development. The audience was gathered through contact with existing social groups in the community and through the random attraction of the medium itself. In Dakar, as in other African cities, neighborhood associations with local councils are active in almost all districts. In addition, women would stop in just to see television and be quite surprised to find themselves part of an educational experience in which the follow-up discussion assumed as much importance and time as viewing the program itself. The formula seemed perfect on the face of it, and the impact not only of the programs but also of the focus for community cooperation was impressive. Nevertheless, the problems encountered in applying the teleclub formula to Dakar offer some lessons from experience.

The officials of the "Service d'Animation" were not integrated into the local communities: frequently, they did not even live in the quarters for which they bore responsibility. They tended, therefore, to conduct the teleclubs like school masters, social workers or political organizers who direct the community but are not a part of it. When other duties called them elsewhere, or when they simply did not show up at

the time of reception, the group was left without leadership and reception degenerated, at best, into a mere viewing of programs. Gradually, however, and thanks to a number of training courses, local leadership was promoted among the audience groups themselves. Only then did the clubs take on their full vitality.

Television has an uncanny fascination, especially for children who would crowd around the receiver on the floor, laugh and chatter, understanding little of the content but enjoying the show. Mothers carried their crying babies on their backs, people came and went, and the restless atmosphere made it difficult for the nucleus of the teleclub to follow the sessions seriously. Exasperated by this lack of discipline, the women finally decided to take matters in hand. Some were posted to control entrance to the room where the set was placed, others were assigned to keep the children quiet or to ask women whose children cried too loudly to leave the room.

The major decision was, however, to make a distinction between the viewing portion of the session and the follow-up discussion. During the former, everyone could sit the way he wanted, with the children naturally in the front. But when discussion started, chairs were rearranged in a circle for the women who were members of the teleclub, while the rest of the people were permitted to remain quietly in the background without intervening in the discussion. No doubt many a fruitful contribution was thus eliminated by those not authorized to speak, but the system was preferable to the lack of discipline which had reigned before, and it served to stimulate a large community group to follow the teleclub discussions.

Feedback from audience to producers and experts proved less of a problem because most conveners were literate, the number of teleclubs small and distances short. Reports flowed in steadily and were reinforced by continuous personal contacts with the audience by a Senegalese sociologist. The fact that he took an active part in the production team, and even in the programs themselves, may have hampered his independent evaluation of the experience, but it greatly enhanced his operational value as a participant observer.

The audience rarely adopted a position of "we" and "they" when it viewed television. Identification with the programs was, of course, further enhanced when the clubs themselves began to participate in certain productions. The groups were in such intimate contact with the producers and felt so much part of an exciting experience that it did not occur to them to feel that they were only on the receiving end.

[Extracted from Mass Media in an African Context: An Evaluation of Senegal's Pilot Project. Paris: UNESCO, 1974, pp. 13-25.]

Educational Radio in Senegal

Henry R. Cassirer

[Educational radio broadcasting in Senegal includes a program for transmitting field recordings and letters of questions and complaints by farmers, along with official replies. This program is considered to have been influential in alerting the government to widespread farmer grievances, and in the subsequent implementation of reforms.]

"We folks of Keur Ameth Sene, we say that educational radio is our Parliament representative because it does for us what our Member of Parliament is supposed to do. We can tell all our grievances to educational radio. We used to tell them to the chiefs of the Cooperative but that didn't do any good. Peasants like us, we can't see the Prefect or the Governor every time we want. Now we can talk things over with the Government in the shade of our trees." (Letter from Senegalese villagers to the Radio Educative Rurale).

It is past nine o'clock on Sunday evening in the village, and some thirty peasants begin to gather under the baobab tree. One of them brings along his transistor so all can listen to a program of the Radio Educative Rurale (R. E. R.) broadcast in their own language, Wolof. What they hear is not only good advice from experts in the studio, but above all the voices of other peasants throughout the country who raise questions, criticize the authorities or, on the contrary, express their satisfaction and pledge themselves to pay their debts.

The R. E. R. is the one part of a pilot project for the use of audio-visual media in adult education, undertaken

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jointly by Senegal and UNESCO. It was set up in 1968 as an interministerial service to the rural people of Senegal. It goes on the air three times a week; on Wednesdays and Fridays, the 15-20 minute programs are largely devoted to the practical issues of groundnut planting, fishing, farming, health maintenance and other problems. On Sunday, however, the much longer program is filled with the voices of the peasants, recorded in the villages or expressed in letters to the station. Whenever questions are raised or policies challenged, the technical services concerned are given an opportunity to reply and explain their action.

At the village level, local listeners' groups are organized on a voluntary and self-governing basis, though frequently stimulated by the rural extension services workers. Beyond these organized groups, however, there is a vast audience throughout rural Senegal where Wolof is spoken, for home receivers are widely available and interest is high in this authentic voice of other people. During a random visit to one of the villages where group listening did exist, I asked how many home receivers there were. Thirty to forty, I was told. In that case, why do you get together in the village square to listen three times a week? "Because, when I listen at home, I only pay half attention. But when I come here I not only listen more carefully, but we can also discuss the broadcast and then decide on what to do about it, either by writing a letter or by acting right here in the village. We could not do this if everyone listened at home."

The audience is, however, not confined to villagers. The program is very popular in Dakar too, where people either like to hear what goes on in the villages where they came from, or are eager to learn about the peasants' world of which they know so little. But, what is even more important, the programs are followed with equal attention by political leaders and government officials, including the President, for the people are telling them the truth, and if it is not heeded there may be trouble.

Such trouble may happen on a large scale, as when the peasants refused to pay their debts because they challenged the way they were contracted, and found themselves incapable of raising funds when the price of groundnuts fell and the rains were wanting for three long years of drought. "We peasants work eight months out of 12, and then we only earn less than 15000 CFA francs [U. S. \$1=243 francs CFA]. And if we don't pay up our debts, they throw us into the secco, they delouse us and beat us up. Now, it happens that if a government man earning 100,000 a month cheats the State out of millions, nobody beats him up. They just lock him up in jail, they find him an office, and his wife sends him a fine roasted chicken for every meal. Are we, therefore, inferior to government officials? Are they citizens any more than us peasants?"

Freedom of expression, lack of censorship and recording of at least 70 percent of the programs outside the studio, is the key to the success of the R. E. R. which is not merely a means to disseminate knowledge and to correct abuses, but a democratic force in society. This is the feeling of an outside observer as well as of the highest authorities in Senegal.

The Director General of the organization in charge of cooperatives and technical services in rural development (ONCAD), Adrien Senghor, put it this way: "At the beginning, we thought that the educational broadcasts were biased against the ONCAD because of the strong criticism of cooperatives. But after closer collaboration we saw that they were quite objective and very valuable. Formerly, all information from the base was 'filtered' and came to us with much delay. Radio enables us to get much faster to the base, both by listening to it and telling them our side of the story. But this is only possible because there is no censorship despite the frequently strong complaints by the peasants -- who would not listen to the programs and to our comments if there were no freedom. For 'whatever is not freely exposed is not easily accepted well here.' Some of our agents accepted well this public criticism, others resented this 'trespassing the limits of normal hierarchy.' But the radio kept them in line, and today we have no problem in collaborating with it."

Malaise Paysan (Peasant Unrest)

The Minister for Rural Development, Habib Thiam, attributed much of the recent success of rural development to the impact of radio broadcasts. He recalled that during the period of the malaise paysan, as President Senghor called it, he travelled throughout the country, meeting with all village chiefs, cooperative presidents and weighers, some 20-25,000 persons in all. And, every time, the radio was there, broadcasting live the forthright discussions. "We had a national forum, and when I came later to new areas, I found an audience already prepared for a frank dialogue. For Senegal, this was a real revolution." Habib Thiam beamed when he recalled the peasants' refusal to pay their debts, and later in 1972 the rate of reimbursement reached almost 100 percent.

The Minister of Information, Ousman Camara, placed the R. E. R. into wider political perspectives. "Educational radio has revolutionized the people and is helping their civic training. Today the peasants have a third way because they have every confidence in Radio Educative whereas they distrust the other ways." Explaining what he had in mind, he then pointed out that in the past there existed only two channels of communication between government and people: the political authorities, elected representatives and party agents at the base (the first way), and the administrative cadres of the state (the second

way). The peasant never had an opportunity to express himself directly. Today he reaches the top — including the President who carefully reads the letters circulated through government departments.

Looking back on almost three years of Rural Educational Radio in Senegal, it is possible to define more clearly what the R. E. R. is and what it has done. At first, it was an outcry of alarm, the ventilation of a feeling of misery, exploitation and frustration. The peasants did not challenge the basic system of the country but its application and operation. The authorities made serious efforts to answer the complaints or to correct their shortcomings, and they employed the radio — at the same time — to instruct peasants in the use of new farming techniques, of new seeds and fertilizers, of agricultural equipment and rural institutions. But the real education went the other way. It was the peasants who educated the authorities about the realities of the country. It was educational broadcasting but not education in the traditional sense where presumed experts instruct the illiterate. Since the people knew best where the shoe hurt, they taught the experts.

R. E. R. and Reforms

A second phase of R. E. R. was ushered in by President Senghor, in a speech in March 1970, in which he analyzed the situation in rural areas, basing himself largely on the information gathered from the R. E. R. It was then that he alerted the country to the malaise paysan. This was the starting point for a series of far-reaching reforms which were frequently announced by the Ministers concerned through the channel of the R. E. R.

As a first stop-gap measure, it was decided on 31 May 1970, to pay to the peasants an exceptional refund amounting to 594 million CFA francs. Two interministerial councils examined the emergency conditions and on 14 June the Prime Minister announced publicly a basic reform of cooperatives. The Minister of Rural Development set out on his tour among the peasants. The cancellation of back debts was the culminating point of this government action. The peasants received concrete confirmation that *Dissoo*, a Wolof word signifying dialogue and mutual confidence, had not been chosen in vain as the title of the radio programs. When they found their complaints answered, the tone of their letters turned from grief to praise and enthusiasm. Of course, the turn of events cannot be ascribed exclusively to the radio and to government measures taken in response. The rains had come at last, the parched countryside turned into luscious green. But as the Minister for Rural Development remarked, rains or no, "If the people are not psychologically ready, nothing matters." As long as cooperatives were run by autocratic presidents, as long as illiterate peasants were cheated when their sacks of groundnuts were weighed at the end of the harvest, as long as work on the land seemed to mean

nothing more than hard labor to pay debts which were contested from the start, as long as the single staple crop did not pay and there was no determined effort to promote other crops, the peasants were prepared to go on strike, and to cultivate only for their own immediate consumption needs, rather than go out to the groundnut fields. (Groundnuts are the country's major export.)

But government measures are one thing, their application another. Here, then, came the third task of the R. E. R.: to control the implementation of these measures at the village level, to keep a constant check on the quality, effectiveness and honesty of extension agents, cooperatives' employees, of governors, prefects and party officials. When peasants write that they have received their refunds or compliment the crop weigher on his honesty, there lies behind these compliments the knowledge of what happened in the past and the threat that they are ready to denounce again every instance of abuse and cheating.

It may be argued that control is a two-edged sword, that the flow of information from the peasants enables governments better to control and dominate them. But if freedom of expression is assured, the dynamics of change are shifted noticeably toward the people. To turn mass media from one-way channels into two-way channels of communication takes statesmanship and courage, as well as professional skill to assure close interaction between production and reception. Just as political and administrative structures require constant criticism and control to assure that they be servants rather than masters of the people, the communication media cannot fulfil their democratic role as long as they remain privileged tools for media professionals, politicians and entrepreneurs. To build a "third way" of government communication through the media is a challenge for society as a whole.

[Extracted from "It's All Just One Big Village," Ceres. Rome, Italy: Food and Agriculture Organization of the United Nations, Vol. 5, No. 6, November-December 1972, pp. 32-35.]

Television and Educational Reform

Wilbur Schramm

[Educational television was an integral component in four major reforms of national or territorial systems of education. While the reforms appear more important than the instructional use of television per se, the medium served as an influential catalyst in helping to bring about changes.]

So far as we know, there have been only four instances in which instructional television (ITV) has been used massively in an effort to accomplish swift reform of a national or territorial system of education. These include, however, some of the most spectacular and most closely studied examples of instructional media in developing areas.

<u>Place</u>	<u>Starting date</u>	<u>Serving what levels</u>
Niger	1964	First five grades
American Samoa	1964	All primary and secondary grades, plus preschool and adult services
El Salvador	1969	7th, 8th, 9th grades; now expanding to primary school, teacher training, and out-of-school education
Ivory Coast	1971	First two grades; expanding a grade at a time to cover all six primary grades; also in-service teacher training

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All these projects have depended upon television. Whether it is necessary to use television rather than a less expensive medium we can hardly say from the evidence: apparently no country or territory has tried to use another medium such as radio for the same purpose. It may well be that a large and dramatic medium like television, which is able to serve wide areas and to deliver both visual images and sound, is necessary in order to catalyze change throughout a change-resistant system like education. On the other hand, there may have been a touch of opportunism in some of the decisions to use television: with a television project it was possible to obtain outside financial assistance.

Common Elements in the Four Projects

The objectives. When Niger entered upon its experiment in educational reform, only about seven percent of the children of school age were in school. From the viewpoint of the Niger government, the main objective was to find a way to expand primary school enrollment rapidly. There was also an anticipated shortage of teachers who would be needed if schools were expanded, and ITV was intended to meet both these needs. On the part of the French Ministry of Cooperation which furnished most of the financing, there were certain additional objectives, however. They wanted to test the assumptions that ITV could reduce dropouts and failures in a developing system, that it would permit the use of briefly trained monitors in place of qualified teachers, that it could be used to teach French to children who had never spoken the language until they came to school, and that it could be used effectively to build a desire to learn.

The educational reform project in American Samoa was in part a response to a feeling on the part of the U. S. government that it had neglected the territorial schools. Universal education had been extended through high school in 1961, but the teacher corps was composed mostly of persons who had gone no farther than the ninth grade and had little command of English even though that was supposed to be the language of instruction. Primary schools were mostly one-room schools taught in open fales. A Congressional committee had recommended consolidation of schools in suitable buildings, a revision of the curriculum to make it more relevant to Samoan life, and, above all, an improvement in the standard of English in order to open doors to learning in school and permit Samoan graduates to move freely into American life if they so wished. The reform therefore was envisaged as a swift upgrading of Samoan education under the new conditions of universal participation, overleaping the time required to train teachers adequately, and concentration, especially in primary school, on mastery of English language.

El Salvador saw its "Plan Basico" — seventh through ninth grades — as the weakest link in its educational pipeline of manpower into economic

and social development. Planners and educators felt that the quality of instruction needed to be improved generally, both for its individual effect and its national results. Wastage of manpower needed to be reduced, and enrollment rapidly expanded to full free universal education in Plan Basico without a loss in quality. The seventh, eighth, and ninth grades (now called the Third Cycle of national education) were to be merely the first targets. After the reform was established there, it was to turn next to the Second Cycle (fourth through sixth grades), to the inservice training of First and Second Cycle teachers in the revised curriculum and new methods, and to the provision of second-chance opportunities to adults who had left school early.

The Ivory Coast, with only about 25 percent of its age cohort in school in the first grade in 1967-68, 18 percent in the second grade, 16 in the third, and 14 in the fourth, wanted to achieve universal primary education (six grades) by 1980 or 1985. This was required, the national planners felt, by the country's ambitious plans for national growth. "Economic and social development must be backed up by a policy of promotion and training of manpower," they said in an official publication. They needed a system to "reach the greatest number of people [and] at the same time give training to teachers capable of discharging their mission."

Thus, all four projects were aiming at universal, or at least greatly expanded, enrollments. For American Samoa, which already had more than 85 percent of its school-age children in school, this was less of a problem than for the others. Niger and the Ivory Coast faced the problem of multiplying their primary school enrollments by a factor of five or more; El Salvador wanted at least to double enrollment in its Third Cycle of public education. All of the countries were also concerned about the quality of the education they were offering, about "modernizing" its content and method, and making it contribute more to economic and social development.

All the projects had substantial outside support. None of these projects came into being without substantial assistance from outside. Niger received capital assistance in the neighborhood of \$1.5 million, and more than a half million dollars annually in recurring costs, from France. France supplied 27 educators and 25 technicians. Samoa, during eight years, had over \$2.5 million in TV capital funds from the U. S. Department of the Interior, plus large capital appropriations for new schools, large numbers of experts from the mainland, and generous annual budgetary support. El Salvador received loans and grants totalling some \$10 million, most of it from the U. S. Agency for International Development (A. I. D.) and the World Bank, with smaller amounts from UNESCO, UNICEF, Great Britain, Japan, and Mexico. The Ivory Coast, has had extensive help from France, which will total \$5 million over the first five years, and a World Bank loan of

\$11.2 million. Lesser help has come from Canada, West Germany, Belgium, the United States, and elsewhere: the total is in the neighborhood of \$18 million.

They all relied upon television for core teaching. Although the television programming that was produced differed widely among the projects, they all depended upon it to carry the core of the teaching. That is, it was not a supplementary teaching aid that a teacher was permitted to accept or reject at will; it was an integral part of each course and of the student's schedule.

All the projects had the concept of a "team" to produce television programs including the production technicians, the classroom teacher, and the supervisors and other semi-administrative personnel that had something to say about the teaching. In El Salvador, for example, these production teams were quite specific to subject matter. They included, for each course in each grade, five persons: two subject matter specialists, a tele-teacher, a producer, and a "coordinator," one of whose functions was to hunt up the visuals and film clips. The load on this team was typically to make three 20-minute programs a week and to prepare the accompanying teacher guides and pupil study books. In American Samoa, the production teams were smaller and the load was much heavier. In the first year, some teleteachers had to make as many as 20 programs a week, but now it is about five programs. In Niger and the Ivory Coast, the production staffs are large and somewhat less subject-specific.

Each of the projects also supplied teacher guides and pupil workbooks, coordinated closely with the television programs. In the case of Niger, where monitors rather than qualified teachers are in the classroom, the instructions are often very detailed. For example, one set of basic materials for teachers begins this way: "8:00 a. m. Reception of the children: Be in the school yard, greet your students with a smile. 8:30 a. m. Classes start: Line up the students by size, the smaller at the head of the file. Enter the classroom as you have been taught to do. The children then sit down on their mats and you welcome them with a few words in their own language. 8:45 a. m. Language telecast: "The Meeting": The morning leads off with a musical theme. If they evince the wish to do so, let the children accompany the rhythm by clapping their hands. Then see to it that they listen and keep quiet during the telecast." In other projects, where the classroom teachers are more experienced, the instructions are less detailed. But all the teachers receive a synopsis in advance of the telecasts, and suggestions as to how to make best use of the program. The students are given exercises to do, sometimes lists of unfamiliar words with definitions, sometimes suggestions for individual projects, and occasionally a self-grading test.

Feedback from the classroom. Each of the projects tried to help its production teams by obtaining a constant flow of information on how the programs were being received and what they were accomplishing in the classroom. With only 20 classrooms, Niger could do much of this by means of frequent visits from members of the ITV team. American Samoa collected comments and reports regularly from classroom teachers, and tried as often as possible to arrange for teleteachers to visit classrooms where their programs were being used. The Ivory Coast provided for inspectors, school directors, and other competent observers to send in written reports. Many of these were then discussed in a daily 20-minute program for teachers. El Salvador made the most extensive efforts to obtain current information from the classroom. Teacher report forms were collected regularly and given to teleteachers. Perhaps the most ambitious attempt to find out what was happening to the programs has been a series of tests of learning administered near the end of each course unit.

Inservice training. Each project tried to provide continuing inservice training for its classroom teachers by means of broadcasts and sometimes meetings, in which upcoming topics and programs were discussed and also some of the problems of teaching the subject matter in the course. Among these, the inservice programs of the Ivory Coast and American Samoa were especially interesting. The Ivory Coast broadcast a 40-minute program each Wednesday afternoon, which teachers were required to attend and to join in a discussion following the program. This broadcast was usually devoted to pedagogical problems, such as how to teach in French to a class of children who came to school speaking a variety of native languages. In addition, a 20-minute program was broadcast daily dealing with more specific matters: the content of upcoming programs, and some of the problems and practices reported by supervisors, principals, and teachers. American Samoa, during the first years of its project, placed experienced educators from the mainland in schools as principals. Their role was less to serve as administrators than as teacher counsellors and advisers. They would observe classes and discuss them with the teachers. Along with the teachers, they would view and discuss inservice broadcasts. As the mainland principals have been gradually replaced by Samoans, the role of principal has returned gradually to an administrative one.

Curricular revision. Revision of the curriculum was accomplished in all four of these projects. The most completely new curriculum was developed in Niger. The same team that was making the new curriculum was also responsible for the programs and for the training of classroom monitors, and therefore had maximum opportunity to see its plans incorporated into practice. El Salvador kept its curricular revision ahead of the introduction of television into each grade, but the revision was rather general and left much to the programmers. American Samoa was under pressure to introduce such a vast amount of television

programming that there was little time for a thorough revision of the curriculum in advance. Furthermore, the curriculum had to change constantly as the initial three levels of primary expanded to eight grades, and as the pupils responded to the increased emphasis on oral English. Only in the last year have detailed and formal curriculum guides been published. The Ivory Coast accomplished some curricular revision in advance of television, although the changes were greater in method than in the substance of the classical French plan of studies. However, innovations such as the "new math" were included, and efforts were made to use examples and problems from Ivorian life.

Another important similarity in the experiences described here was that none of these projects came into being very quickly. The usual time was three or four years, and for El Salvador it was considerably longer.

Differences Among The Four Projects

The rate of introduction. Three of the four projects, Samoa excepted, moved at a careful and measured pace into their reforms. The fact that Samoa did not gives us an interesting point of comparison.

The production team in Niger tried out all its television programs, by closed circuit, on two experimental classes during the 1964-65 school year. At the end of this time, the team found it desirable to remake, in whole or in part, about 80 percent of the programs. During the second year, the revised programs (about 400 per school year) were presented to 20 first grade classes (800 students), and second grade programs were tried on the two experimental classes. In the third year, the second grade programs, revised as necessary, were presented to the 20 classes, while new third grade programs were tested on the two experimental ones. At this careful pace, the project moved through the five elementary grades. Unfortunately, up to this time it has never expanded beyond those 20 classes.

El Salvador began at the same pace as Niger, but with vastly larger numbers. In the first year, 1969-70, the initial programs were tried out on 32 seventh grade classes. In the second year, these programs, some of them revised, were broadcast to all seventh grade classes equipped to receive them, and eighth grade programs were introduced in 32 classes. At this pace, the reform moved through the Third Cycle, and the extension of universal free education to those three grades made it possible to double their enrollment to over 60,000 by 1973.

The Ivory Coast offered televised lessons to 447 first grade classes (about 20,000 students) in the first year, 1971-72. In the following year another 979 first grade classes (about 40,000 pupils) were taught with

the aid of television, and television was also introduced to 20,000 in the second grade. Plans were underway to expand the national television network to cover the entire country within a year or two. At the time of writing, it covers about two-thirds of the area.

American Samoa, by contrast, offered television programs to all the elementary schools which could receive television during the first year of the project, and all the high schools in the second year. By the third year of the project about two-thirds of the students in American Samoa were in consolidated schools with television, and by the sixth year almost all the nearly 8,000 students were being taught by television. Thus, until about two years ago, the teleteachers in Samoa were producing 6,000 live programs per year — a fantastic level of production unmatched by any educational station elsewhere in the world. This enormous load of live programming must have had an effect on the quality of the broadcasts to the Samoan schools.

Teachers. The Niger project differed from the others in the use of teachers. The architects of that project decided to use monitors with no pedagogical training, most of them with only a primary school education, rather than qualified teachers. This decision was made for two reasons. For one thing, looking toward a possible very large expansion of the school system, the use of monitors was expected to save money. In the second place, the project directors felt that it would be easier to prepare relatively untrained monitors to fit their new curriculum and their new ideas on pedagogy than to try to retrain teachers who were already anchored in the classical pedagogy. All the other projects used qualified teachers in the classroom.

Teacher training. As we have seen, all four projects tried to provide some inservice training for their classroom instructors. The pre-service training that El Salvador gave its teachers, however, was unique among the four. With a few exceptions, every teacher in the Third Cycle in El Salvador who was assigned to a classroom with television received a full year of retraining at the new training center, with pay, before going to a new assignment. This is the only case in our knowledge when a school system has made use of a new media project to upgrade its teacher corps by such an extensive program of retraining.

Localness and relation to the establishment. While three of the projects are closely integrated into the Ministry of Education of the country, in Niger this is not the case. The 20 experimental classrooms are chiefly the responsibility of the French project staff: they made the new curriculum; they hired and trained the classroom monitors who do the teaching; they are in charge of the television programs and of making the classroom materials. The subordinate technical staff is chiefly from Niger under French supervision. The studio teachers are pedagogically qualified Nigeriennes who are paid by the Ministry of Education

but work under the supervision of the project leaders, and consequently feel a certain degree of divided loyalty and fear that they are apart from the mainstream of promotion and reward within the educational establishment.

The El Salvador project is the most national and the most completely integrated into the educational system of its own country. Although El Salvador has made use of a number of foreign advisers, the project has been from the first completely under Salvadoran control since all the teaching and supervision, the program production and planning has been in the hands of Salvadorans. The Ivory Coast project has been nationally integrated in this way except for the large production team furnished by France and UNESCO. The American Samoa project began under the almost complete direction of American broadcasters and educators, but leadership has now almost completely been turned over to Samoans.

Facilities. All the projects have built adequate studio facilities, and the Niger television building, with three indoor studios, an outdoor studio, and closed circuit to two experimental classrooms is quite impressive. But the ITV facilities of American Samoa are one of the wonders of the Pacific. On those small islands, thousands of miles from any other television, the Samoa Department of Education has six open-circuit VHF channels, broadcasting from two towers high on a mountain over Pago Pago. A cable railway was built to get equipment to the towers. Below, there is a building with four studios, 10 videotape recorders, art and photography departments, engineering repair shops, tape storage facilities, and so forth. A radio communication system links the school administration and television centers with all the schools.

Costs

The Niger project. In the planning stage, it was estimated that the project would break even with the costs of traditional schooling after it reached 170,000 students; but the total enrollment has never exceeded 800. A UNESCO team reported on the current costs of the Niger project in 1969. They estimated that the recurring costs of France and Niger for the first five years of the project would total \$3,875,000. The capital cost was approximately \$1,500,000. For five years, then, the total cost of the project would be \$5,375,000. During that time, 800 students went through five years of school each — a total of 4,000 school years, at an apparent cost of \$1,344 per year per student. This may be slightly overestimated; but even if the building were amortized over 15 years and the transmitter over 10 rather than 5 years, and if notional interest were included, the cost per student-year would still be more than \$1,200. If the project could really have been developed to serve the anticipated

260,000 children, these unit costs would be quite different. The average cost of traditional primary school in Niger is estimated at between \$200 and \$300 per pupil per year.

American Samoa. In 1966, John Vaizey estimated the per pupil cost of television in American Samoa at \$216 per year. He estimated the total cost of Samoan education in the same year as \$357 per elementary school pupil, \$598 per secondary school pupil. In 1972, we estimated the 1972 cost of television at \$157 per pupil per year. Our tentative estimates of the total annual cost of education per student were about \$521 per elementary student, \$705 per secondary student. Thus, the total cost of education had risen considerably, reflecting a notable increase in the total school system budget since 1966, but the per pupil cost of television had decreased. If it were possible to double the enrollment, a rough calculation suggests that the production and transmission services would be sufficient for the larger number of users, and the cost of television would come down to approximately \$90 per student. But the enrollment cannot be doubled unless other areas are served.

El Salvador. When we look at the costs of ITV in El Salvador, we have a somewhat different situation. When Richard E. Speagle made a cost study of the El Salvador project in 1971, the enrollment was near 25,000. At that time he calculated that the annual cost of television per student was only \$14.40 per student per year. With 62,000 students now enrolled, with double sessions the rule and relatively little increase in the teacher corps, the time is ripe for another cost study. A rough calculation indicates that the present total cost per student, with television, may be less than the corresponding cost if the system were taught in the traditional manner, which at present is about \$100; but a reliable answer must await a full reexamination of costs.

Furthermore, El Salvador is about to collect a bonus on its school television by using it for other purposes. The primary school television, which begins in March 1973, will represent an add-on cost, although a rather low one per unit because of the very large enrollments in the primary grades. The use for primary school teacher training, and for offering adult education opportunities to persons who have had to leave public school early, represent substitute rather than add-on expenditures. It should be considerably cheaper to offer teacher in-service training by television than in a teacher training school; and to offer education to adults by television than to bring them back to school. Thus, by making use of already trained production teams and already available facilities, El Salvador may be able to use television for additional tasks at very favorable cost ratios.

Ivory Coast. Except for planning projections, no cost studies have as yet been made for the Ivory Coast. Such a study would be interesting

because with 60,000 students taught by television in the second year and over 100,000 expected to be in television in 1973-74, the unit costs should be quite favorable.

Finally, it may be interesting to record two figures on the actual cost of producing ITV programs. It includes the cost of working out, producing, and recording the programs but not the cost of transmission or reception or of preparing teachers' guides and student workbooks. Samoa's best estimate of this cost is \$1,550 an hour, or about \$550 for a typical 20-minute broadcast. Speagle's estimate for El Salvador production is \$1,280 an hour — \$427 for a 20-minute program.

Results

What have these projects bought for the cost of their instructional media?

Niger's basic reason for the use of instructional television was to make it possible to increase primary school enrollment. In this respect, the project was a failure. Up to the time of this writing, it has never succeeded in reaching more than 800 students each year, whereas the original plans had been to expand from 800 to 18,000 by 1967, and to 40,000 by 1968. Why did nothing like this happen? In part it must have been that the Niger budget was unable to absorb large additional costs. In part it may have been due to the traditional conservatism and suspicion of the Niger rural people. But it is hard not to believe that much of it was due to the passive resistance of the educational establishment. And this in turn resulted in no small part from the fact we have noted: that the project was imported, was operated for the most part separately from the Ministry, that it rejected the trained Niger teachers in favor of untrained monitors, and the traditional colonial curriculum in favor of a new and different curriculum. It had few supporters in the Ministry, and was largely ignored by the education officials. It was treated, in other words, like a French experiment on Niger soil, and not until it came to the end of its planned cycle did the establishment show much interest in whether it continued to exist. Now there is a chance that France may contribute more money, and Niger may try to expand the system. Two thousand tested and revised programs are on tape. What future use they will have is uncertain.

On the other hand, measured against some of the French objectives noted above, the project was far from a failure. Dropouts in the television classroom were practically zero. Children came to school when they were ill, when the weather was bad, and they kept coming week after week, year after year. The monitors worked out very well; the project supervisors said that it was easier and more

successful to train them to the new curriculum and the new methods than to try to retrain traditional teachers. Observers noted that the monitors established a remarkably fine rapport with the children. No very useful studies of learning from the Niger project have yet come to light: a series of criterion-referenced tests were given in the first year, and the children scored very well as measured against passing scores set by the testmakers. French visitors were surprised at how well the children were speaking the language after only two or three years. But the chief success of the project, by the general verdict of people who saw the 20 schools in Niger, was in the excellence of instructional programs it was able to produce.

The quality of ITV programs in many projects has been a source of dissatisfaction to project heads, to educational administrators, and to observers alike. It is perhaps ironic that higher standards are applied to television teaching than to classroom teaching, but they certainly are; and among the reasons are that television costs more and is far more public. The programs in Niger have been almost universally praised by visitors. Relatively few programs were made each year (one-fifteenth as many as were made in Samoa). The pedagogical and production staffs were talented and large enough to eliminate some of the frantic quality of much ITV production. The programs were tried in advance on two classes, and remade if necessary. The result was a series of programs in which typically "les enfants sont plus acteurs que spectateurs" as Television Scolaire du Niger explained. There was very little overt teaching on the TV tube; rather the programs tended to be like "shows for children." They kept the pupils interested and active, and provided many opportunities for them to act out skits they had seen on the tube, or to finish a playlet that had been begun on television — meanwhile, of course, practicing their French and their arithmetic, and enjoying the experience hugely. Officials in the Niger educational system protested that the project was not teaching the skills and knowledge expected of the classical curriculum, and in many cases the programs were modified so as to bring them closer to the traditional pattern. To the best of our knowledge there are no reliable comparisons of what was learned in the 20 experimental schools and a comparable 20 traditional schools, but there seemed to visitors to be little doubt which classes were enjoying the experience of education more.

American Samoa. The objectives of reform in American Samoa were to accomplish a swift upgrading of the system after a long period of neglect, and especially to improve the use of English in the schools, both as a door to learning and a door to later entrance into the United States economy for the 40 percent or so of Samoan school graduates who choose to go to the United States. There is very little doubt that the second of these objectives has been achieved, so far as oral English is concerned. Two linguists visited American Samoa in 1963 and 1964, just before the project began, and described the kind

of English spoken by pupils and teachers. The situation they described was far different from the present standard. Four quantitative studies were made between 1966 and 1969, comparing the English language usage of students who had been in the new system for different numbers of years. We ourselves have tested all the school children on the one Samoan island that had never received television, and compared their performance with that of the children in an isolated school that had little contact with spoken English except in school and on television, and a third school that was not isolated and consequently had access to visitors as well as to English and television in school. The results of this study are impressive. Only three out of 10 children on the non-television island could make any English response at all to simple questions, although the Samoan schools now, as in 1964, are supposed to be conducted in English. The fourth, fifth, and sixth grades on the non-television island scored considerably below the third grade of a village school on the main island of Tutuila, which does have the benefit of television and the new system. This is true of the performance in understanding English, speaking English, and reading English.

However, there are puzzling aspects in the research results from American Samoa. For one, the improvement in oral English seems to have been much greater than the improvement in reading skill. Also, standardized tests given for the last three years in Samoa show that the children do much better on questions based on rote learning than on questions requiring abstract thinking or reasoning. This is a phenomenon seen also in "disadvantaged" groups on the American mainland, particularly in those who come from homes where English is not spoken or where there is no reading matter — which also describes most Samoan homes. In comparison with test scores at comparable grades found among many black, Puerto Rican, Spanish-American, and American Indian groups on the mainland, the Samoan children typically do a little better than these disadvantaged mainland groups on arithmetic, a little worse on reading.

The institutional changes that have come about as a part of the educational reform are perhaps more revealing than the test scores. To an observer (as distinguished from a tester) the system looks a great deal better than it did in 1964. The new schools are attractive and efficient. The teaching seems better. Discussion in the classrooms is replacing much of the chanting of rote responses. Perhaps most important, in these last eight years the system has been turned over almost entirely to Samoan leadership. In 1964, Samoans held little except subordinate positions. The top jobs were all filled by educators from the United States. For several years now almost all school principals have been Samoans, and most of the assistant and deputy directors in the Department of Education have been Samoan. In 1973, the first Samoan Director of Education in the territory's history took office. The fact that television has been cut back from 6,000 live programs to 2,200 per year is a sign of maturity and rising standards, rather than lack of confidence in the medium. Teachers,

especially in the secondary schools, feel better able now to teach their own classes without a crutch. Furthermore, the appearance of detailed curriculum outlines, the establishment of a tests and measurements service, the new disposition to try different kinds of educational practices like team teaching, programmed instruction, and learning games — developments like these represent a long jump from 1964 when the schools were mostly one-room schools in which the children chanted back whatever responses the teacher had on his memory shelves.

El Salvador. The most obvious objective of the El Salvador educational reform — to extend universal education through the Third Cycle without loss of quality, and in so doing to relate the educational system more closely to the needs of the country for trained manpower — has been achieved at least with regard to enrollment and quality. Free universal education has been extended through the ninth grade, and the enrollment in the Third Cycle has approximately doubled. There is no reason (from testing evidence) to believe there has been a loss in quality. Whether the kinds of manpower that are being produced by the revised Third Cycle are contributing more to the needs of economic and social development is not yet clear.

There has been only one true comparison of performance tests between the new system and the old, made for the seventh grade in 1969. The comparisons between learning gains during one school year in the old and new (ITV) system classes in the three subjects measured indicated that the new system classes were gaining about 40 percent, and the old system classes about 10 percent — so far as such gains can be measured by achievement tests of common material. These differences are all statistically significant beyond the .001 level of confidence. After 1969, it was impossible to compare the old and new systems because most elements of the new system except the ITV had filtered into many of the classrooms that did not yet have television.

While the post-1969 data are less controlled, the direction of the evidence is on the side of more learning when a class has television than when it does not. Do we define quality as better teaching? The presence of certain qualities of "modern" teaching in the classroom have been measured — for example, less lecturing, more discussion, more thought questions rather than rote questions, more questions asked and opinions given by students, more individual and groups projects, and so forth. It was found that the new system classes had significantly more of this "modern" teaching than old system classes. The part of the teacher's experience that seemed to correlate with such teaching was the year of retraining. If a teacher had that, he was likely to teach in the way we have described; if he had not been through the retraining course, he was less likely to do so. Do we define quality as the enjoyment of education? If so, the attitudes of students in the new system classes were distinctly favorable toward ITV, and more favorable toward school in general than were the attitudes of students in the traditional classes.

One aspect of the impact of educational reform is illustrated in a study of student aspirations in the Third Cycle. The results of this were rather startling, for the students were aiming far above their fathers both in education and occupation. Whereas less than two percent of the fathers had gone to universities, 40 percent of the students were aspiring to a university education. Although 70 percent of the fathers were working as unskilled laborers, 40 percent of the children were aiming toward professional occupations requiring highly specialized training. These results raised questions of whether the occupational system and the higher education system of the country could possibly handle the tidal wave of students that are moving out of Third Cycle, and whether such aspirations may not lead to widespread frustration rather than filling the ranks of middle level technical employees where El Salvador most needs trained people.

When we are considering the success or failure of the El Salvador Reform, we must not lose sight of the fact that striking and important institutional changes were accomplished in a very short time. For example, the Ministry of Education was completely reorganized and integrated, something that had been needed for a long time but was brought about at last under the stimulus of general change. The system of teacher training was completely reorganized; most of the normal schools of the country were closed, and a new high-quality central teacher training facility was created at San Andres. The curriculum was revised. Most of the 900 teachers in the seventh, eighth, and ninth grades were given a year of retraining with pay, free from teaching duties. The "taxi-teacher," who taught an hour at one school then hurried to another, never seeing his students outside class, was abolished and replaced with full-time teachers. These are dramatic changes, and the fact that they and others all occurred within three years indicates that the Reform movement had the power to bring about changes that otherwise might have taken many years or might have never happened.

Ivory Coast. It is too early yet to say how close the Ivory Coast project is to achieving its objectives. It is evident, though, that the project is moving toward the goal of universal primary education. In the first year 20,000 taught with the aid of television in first grade; in the second year, 20,000 in grade two and 40,000 in grade one. In the third year there are expected to be more than 100,000 in the new system classes.

Some Conclusions

We can conclude that these projects have been able to bring about changes. They have not in every case done all that was intended, and sometimes not in the way intended, but each has been able to make considerable change in a short time in one of the most change-resistant of social institutions, the formal school system. But we have not yet answered the question; does it have to be done with television?

There is no hard evidence on the question; apparently no one has ever tried to bring about national educational reform with radio or

films or any other medium, large or small, except television. We have put the question to representatives of these reform projects. They have replied, with variations but no essential disagreement, that such a task would be harder to do without television and harder to do with a medium other than television.

Their arguments are like this:

- the size of television and its logistic demands require a major commitment to change, and consequently make other changes easier.

- television imposes a schedule on change. The decision to go on the air at a certain time requires curriculum revision in advance of that, requires financing to be arranged still farther in advance, requires professional training before the equipment is in hand, requires that teachers be prepared and that classroom guides and other materials be ready before ITV teaching begins in the classrooms, and so forth.

- the dramatic quality of the technology attracts wide interest and symbolizes for a wide audience that change and "modernization" are occurring.

- the excitement of television sometimes leads participants in a project to undertake tasks they might otherwise hesitate to attempt. This is what Hirschman was talking about when he wrote: "Since we necessarily underestimate our creativity, it is desirable we underestimate to a roughly similar extent the difficulties of the tasks we face so as to be tricked by these two offsetting underestimates into undertaking tasks that we can, but otherwise would not dare, tackle."

- television catches the interest of the pupils, who are inclined to think of its introduction as something new in an old routine.

- television makes it easier to obtain financial help from outside.

- in other words, they say, television is a mover, a catalyst of other changes in the system, and its effect as such may be more significant than its direct effect on learning. They also feel that television can do more things than radio and is vastly easier to prepare and deliver than films.

We present these ideas for what they are worth. They come, of course, from people who have been involved in a project with television and, consequently, would be inclined to defend their use of it. It would be of interest to see an attempt to bring about national educational reform with radio rather than television as the chief media component. If another instructional medium can do as well, that remains to be proved. From the four experiences reported in this study, however, we can draw some conclusions about the effective use of instructional television for widespread reform:

1. None of these projects could have gone forward successfully without substantial support — financial, logistic, and technical — from outside. This raises the question of whether such "forced feeding" is the best way to encourage national educational reform, or whether a simpler, less expensive method, supportable largely by local resources, might be more lasting even if somewhat slower. For example, one reason the Niger project stalled after reaching 20 classrooms was the feeling of the host government that its budget would not support a broad expansion. Similarly, the ITV station that UNESCO helped build in Senegal went dark when the UNESCO project ended. Nevertheless, Samoa, El Salvador and the Ivory Coast will probably be able to absorb the recurring costs and technical demands of their projects, although outside help was required to get them started.

2. None of these projects could have come into existence, and none of them could have continued for very long, without strong support from the top. In Samoa it was the vigorous backing of Governor Lee; in El Salvador, the strong support of Minister Beneke; in the Ivory Coast the support of President Houphoet-Boigny. In Niger, President Diori's interest made possible the existence of the project, though the fact that almost no other strong support existed in the government made it difficult for the project to expand beyond the experimental stage.

3. Each of these projects encountered strong resistance at some time in its development. The principle seems to be that change of such magnitude always creates a delicate situation and rouses defenses. In Niger, the opposition came from the educational establishment — the Ministry whose curriculum and methods were rejected and the Teachers Union whose members were rejected in favor of untrained monitors. In Samoa, the first opposition came from members of the Department of Education who did not believe in teaching by television; this was overcome by Governor Lee's determination to change the system quickly. Later there was political opposition, apparently using the schools as a device to strike at territorial officials. Still later, the secondary school teachers, feeling more confident, became dissatisfied with having to share so much of the teaching with the television teachers. In El Salvador, the chief opposition came from the Teacher Union, which was dissatisfied with salaries, and struck at television mainly because they felt the money it cost should have gone into higher pay for classroom teachers. In the Ivory Coast, not all members of the Ministry were convinced that television should be brought in to change the established patterns. A minister had to be replaced, apparently because of his opposition.

4. It is at least a reasonable hypothesis that after a certain time the newness of television wears off, and after that occurs the use of television or the gadgets of television must be somewhat changed. For example, in Samoa, after eight years, television seems to be taking on a different function — no longer being used to carry the core of all teaching, but rather to do the things it can do best, and to be

used more sparingly and more discriminatingly. In El Salvador vision is being turned toward other targets — the primary school, the adult audience, and teacher training — and it is predictable that in time the amount of television used in the Third Cycle will be reduced and its uses will become more specialized, as in Samoa. In Niger the situation is a bit different because television is supporting the monitors and, in any case, is not conceived to the same degree as presenting a "master teacher." More often it presents, as one of the leaders of the Niger project said, an instructional "show." Programs of this kind are less likely to be seen as competitive with the classroom teacher, even when the monitors grow in skill and confidence or when qualified teachers are used.

5. It is clear that none of these projects is really a purely "television project." Television is hardly a self-sufficient instructional tool. It needs teachers' guides, study materials for students, visuals for classroom use, and all the other tools of instruction that a live classroom needs. Furthermore, institutional changes of the kind we have mentioned may in the long run be responsible for more "reform" than anything television may contribute to learning. In other words, television must be built into a system, and its ability to help bring other elements of the system into existence may be more important than its direct effect on students.

6. If one introduces such a televised system faster than one grade at a time, one risks serious administrative difficulties. This is well illustrated by the experience of American Samoa, which would have found its task vastly easier technically and administratively — although perhaps not politically — if it had not decided to serve all 12 grades at once.

7. If a national educational reform project is expected to continue, to reach national dimensions, and to be absorbed into national budgets and plans, it needs to be integrated from the first, not only into the local culture but also into the local power structure, to avoid the aborted outcome in Niger.

[Extracted from Chapter 5 of Big Media -- Little Media, pp. 112-168. Washington, D. C.: U. S. Agency for International Development, 1973. A. I. D. Series in Educational Technology.]

INDEX - VOLUME XII, 1974

Subject

Africa

2:24-30, 77-82;
3:56-62; 4:90-107.

Agriculture

Cooperatives

Comilla

2:37-44

Group Credit

2:3-14

Guatemala

2:15-23

Gujarat

2:45-52

Nigeria

2:24-30

Politics of

2:31-36

Marketing

Agribusiness

4:74-80

Development Tool

4:55-56

Government Services

4:57-63

Small Farmer Credit

Conditions for Success

1:47-53

Reaching Small Farmers

1:61-64

Technology and Profit

1:54-60

Banking

Central Banks

2:67-76, 83-89

Indigenization

2:77-82

Rural Savings

2:90-94

China, People's Republic of

2:115-124

Communication

In Technical Assistance Problems

3:81-94

Culture Simulation

3:95-98

Media

Development Role

4:83-89

Educational Radio

4:103-107

Television and Education Reform

4:108-124

Television in Dakar

4:90-102

Disaster Relief

1:113-124

Growth, Limits to

4:3-52

Guatemala

2:15-23

Health Planning

China

2:115-124

Combining Health Care and Medical Training

2:109-114

Cost of Medical Education

2:97-108

Hong Kong/Singapore

3:101-124

Housing

Africa

3:56-62

Development Strategy

3:67-78

- Housing Assistance
 - 3:63-66
- "Minimum Standard Approach"
 - 3:43-48
- Sites and Services Programs
 - 3:49-55
- India
 - 1:13-28, 2:45-52
- Inequality, Tolerance of
 - 2:55-64
- Latin America
 - 1:42-44, 81-87;
 - 2:15-23; 4:64-80
- Limits to Growth?
 - 4:3-52
- Multinational Corporations
 - Forced Divestment
 - 1:81-87
 - Impact on Labor
 - 1:88-101
 - R & D in Developing Countries
 - 1:102-110
 - Role in Development
 - 1:67-80
- Nigeria
 - 2:24-30, 77-82
- Population
 - Fertility Disincentives
 - 1:8-12
 - Impact of Economic Development
 - 1:29-35
 - Latin America
 - 1:42-44
 - Myth of Population Control
 - 1:13-28
 - Status of Women
 - 1:36-41
 - Supply and Demand in Family Planning
 - 1:3-7
- Raw Materials
 - Food
 - 3:27-40
 - Non-Fuel Minerals
 - 3:16-26
 - Price Trends
 - 3:3-15
- Senegal
 - 4:90-107
- Singapore
 - 1:8-12; 3:113-124

Authors

- Anania, Spartaco
2:31-36
- Ascroft, Joseph
3:81-86
- Abel-Smith, Brian, Lars Ekholm,
Herbert E. Klarman and
Vincente Rojo-Fernandez
2:97-108
- Bhatt, V. V.
2:83-89
- Brimmer, Andrew F.
2:67-76
- Brown, Lester R. and
Erik P. Eckholm
3:27-40
- Burley, Lawrence Anderson
1:113-118
- Carroll, Thomas F.
2:3-14
- Cassirer, Henry R.
4:103-107
- Comercio Exterior de Mexico,
Editors
1:42-44
- Currie, Lauchlin
3:67-76
- Department of Economic & Social
Affairs, United Nations
Secretariat
1:67-80
- Donald, Gordon
2:90-94
- Eckholm, Erik P. and
Lester R. Brown
3:27-40
- Ekholm, Lars, Brian Abel-Smith,
Herbert Klarman and
Vincente Rojo-Fernandez
2:97-108
- Fledderjohn, David
2:15-23
- Foster, George M.
3:87-94
- Gotsch, Carl
1:61-64
- Guthrie, C.
4:64-73
- Geiger, Frances M. and
Theodore Geiger
3:101-124
- Hagen, Toni
1:122-124
- Hall, Peter
1:8-12
- Henderson, Hazel
4:44-52
- Herz, Barbara
1:3-7
- Hirschman, Albert O.
2:55-64
- Hosken, Franziska P.
3:56-62
- Human Settlements, The
Editors
3:49-55
- International Labor Office
1:88-101
- International Planned
Parenthood Federation
1:36-41
- Kaplinsky, Raphael and
Susan B. Rifkin
2:115-124
- Klarman, Herbert, Brian
Abel-Smith, Lars Ekholm
and Vicente Rojo-Fernandez
2:97-108
- Kimm, Peter M.
3:63-66
- Lindquist, John T.
1:81-87
- Long, Millard
1:47-53

Mamdani, Mahmood
1:13-28

McCauley, E. Hunt
2:45-52

McClure, Russell S.
1:119-121

Meissner, Frank
4:55-56

MIT International Project Team,
Dennis L. Meadows, Director
4:3-31

Mittendorf, Hans
4:57-63

Myers, Desaix
2:37-44

National Academy of Sciences
1:102-110

Nwankwo, G. O.
2:77-82

Ortiz Mena, Antonio
4:74-80

Patel, A. U. and Ebun Williams
2:24-30

Prywes, Moshe
2:109-114

Rich, William
1:29-35

Rifkin, Susan B. and Raphael
Kaplinsky
2:115-124

Rojo-Fernandez, Vicente, Brian
Abel-Smith, Lars Ekholm and
Herbert Klarman
2:97-108

Rogers, Everett M.
4:83-89

Sadove, Robert
3:43-48

Schnapper, Melvin
3:95-98

Schramm, Wilbur
4:108-124

Takeuchi, Kenji and
Bension Varon
3:16-26

Tinnermeier, Ronald
1:54-60

UNESCO Staff
4:90-102

Varon, Bension and
Kenji Takeuchi
3:16-26

Williams, Ebun and A. U. Pate
2:24-30

World Bank Group Staff
3:3-15

World Bank Task Force,
Mahbubul Haq, Chairman
4:32-41

